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VOLUME 109, NUMBER 23

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Published every Thursday. Price 25c. per copy. Subscription, domestic, central and South America, $5 per year. Canada, including duty $7.50. Foreign $9 or 45 shillings. Entered as second-class matter April 11, 1917, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Cable Address: "MCGRAW-HILL, New York." Member A.B.P. Member A.B.C.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

Editorial and Publishing Offices: 330 West 42d St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England. Branch Offices: Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C.; Los Angeles. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President and Editorial Director; Harold W. McGraw, Vice-President; C. H. Thompson, Secretary.

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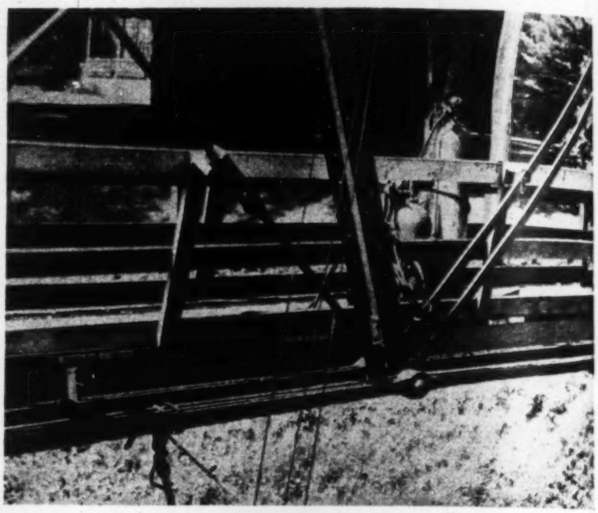

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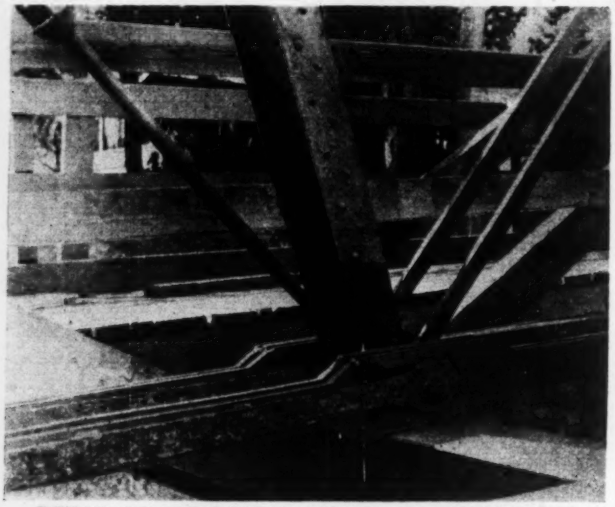

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News-Record

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Concreting Plant for Madden Dam

Plant for preparing aggregates and mixing and placing concrete in 500,000-cu.yd. dam for the water supply of the Panama Canal is designed for complete salvage and independent re-use of separate units

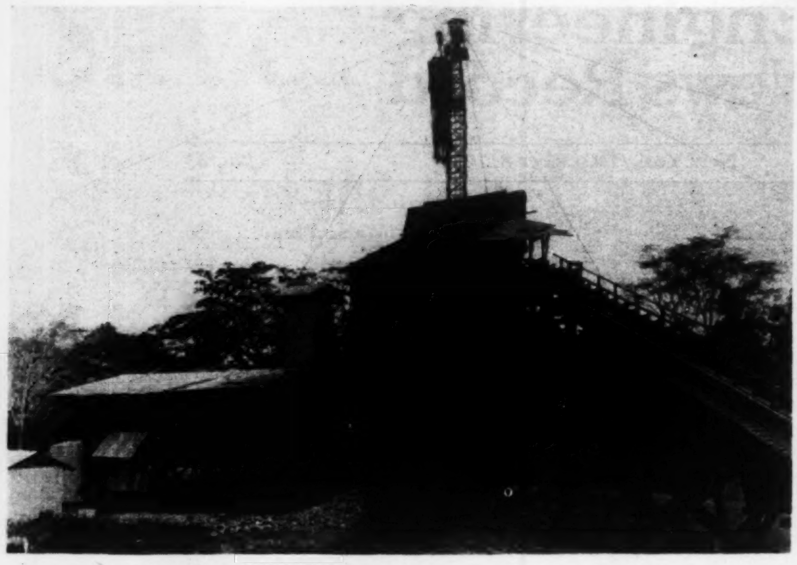
By Adolph J. Ackerman

Chief Engineer, W. E. Callahan Construction Co., and Peterson, Shirley & Gunther, Contractors, Madden Dam, C. Z.

THE CONSTRUCTION of the Madden Dam to increase the water supply for the Panama Canal required a plant capable of producing nearly 500,000 cu.yd. of concrete. Though located on the Chagres River, only 10 miles from the canal, the site is in veritable tropical jungle. All deliveries to the dam are by a truck road from the Panama Railroad. Plant construction and design therefore had to satisfy exceptional requirements aside from adequate capacity to produce and place concrete. This article describes what was done and why and how it was done. An article in *Engineering News - Record,* July 30, 1931, p. 162, described the reservoir and dam structure, and another in the issue of Oct. 1, 1931, p. 548, gave the quantities involved in the construction. The contract was awarded Sept. 15, 1931, for $4,048,657. During the first year the contractors have completed extensive clearing operations, erected a modern village and numerous shops, completed cofferdams and all excavation for the first stage of dam construction, and recently placed in operation one of the most modern concreting plants ever constructed. Practically all of the plant is new, and while designed to meet the special conditions of this job, particular consideration was given to securing a high salvage value by making each unit readily adaptable to other projects.

General view of concrete plant area, showing screening plant, conveyors, mixer plant and cement silo.

All important and salvageable structures were built of structural steel, partly because of the favorable steel market and because of the rapid decay of wood due to climatic conditions, but mainly to create a plant of maximum dependability and one low in maintenance expense and fire hazard. The shop-riveted members were designed for compact shipping and easy assembly and dismantling; field joints were generally bolted, in some cases with a special patented "rivet-bolt," which can develop the same strength in a joint as is obtained with hot-driven rivets.



Tramway-loading terminal and gravel bin designed for receiving material either from cableway excavator or belt conveyor extending down to dump hopper for railroad cars.

The great distance from the American manufacturing centers required that all mechanical equipment be selected on the basis of simplicity of design and reliability of operation, so that with a reasonable supply of spare parts all repairs could be readily made on the job.

Aerial tramway

Taking up the various units of the plant in the sequence of material movements, the first important unit is an aerial tramway one mile long, capable of delivering 225 tons of gravel per hour to the screening plant. While the Chagres Valley contains an almost continuous gravel deposit, it was necessary to open a pit about a mile downstream from the dam site in flatter country, where an abundant supply of proper gradation was available, particularly with respect to sufficient fines. About 600,000 cu.yd. of gravel will be transported over this tramway.

The gravel is loaded by a $2\frac{1}{2}$-yd. walking dragline into 5-cu.yd. side-dump cars operating on a narrow-gage track. These cars dump at the tramway loading terminal through 8-in. grizzlies into two hoppers set below ground level. Two feeders, one under each hopper, are so arranged that they feed toward each other onto a 36-in. belt conveyor; they are driven by suitable gears from the tail pulley of this conveyor. Either feeder may be disengaged for inspection or repairs by a clutch. The conveyor, about 200 ft. long, discharges at the top of a 360-cu.yd. tramway loading bin. As an auxiliary means for loading this bin, its top has been covered with grizzly bars, and a 2-cu.yd. cableway-excavating unit has been erected; this can reach about 100,000 cu.yd. of gravel in front of the bin and load directly into it.

On the tramway side of the bin two air-operated gates feed the gravel into buckets of 32-cu.ft. capacity at the rate of two per minute. The buckets are automatically spaced and dispatched out onto the line, the grips taking hold of the endless-load cable as the buckets leave the terminal. The buckets entering the terminal are in a similar way automatically released from the load line and come to rest at the loading spouts. Normally four buckets are in the terminal at all times and 50 on the line. The conveying speed is 500 ft. per minute, and the buckets are spaced on the line at 256-ft. intervals. A 100-hp. motor is required to keep the 2-mile circuit of loaded and empty buckets in motion.

The track cables are of lock-coil construction, the main cable being $1\frac{1}{4}$ in. in diameter and the return line 1 in. in diameter. The line crosses the Chagres River twice; its longest span is 1,826 ft. and the shortest 500 ft. The five lightly loaded towers are of timber construction, but the double-tension tower that supports four dead ends of cable is built of structural steel. The American Steel & Wire Co. supervised the design and erection of the tramway.

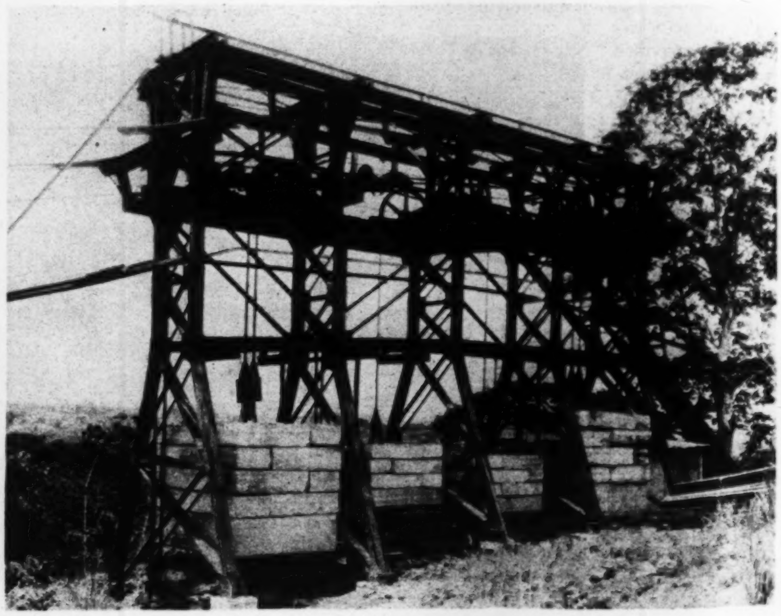
The discharge end of the tramway is located at the main plant area adjacent to the dam site. The terminal was mounted directly on top of the screening plant to provide a gravity flow to the screens. Opening, dumping and reclosing of buckets is entirely automatic without stopping them, and their return travel is accomplished by passing them around a 16-ft.-diameter sheave. The receiving hopper is 24 ft. long and has a capacity of 30 bucket loads.

Screening plant

The screening plant is required to produce five different products: sand; pea gravel, $\frac{1}{4}$ to $\frac{3}{4}$ in.; two sizes of gravel, $\frac{3}{4}$ to $\frac{1}{2}$ in. and $1\frac{1}{2}$ to 3 in.; and cobbles 3 to 8 in. in size. The plant was laid out on the principle that greater reliability of operation would be secured from utilizing gravity rather than mechanical conveying means between units and to the storage area. This has resulted in a very simple arrangement, although one of greater height than is normally found.

The gravel is drawn from the tramway hopper by a heavy cast-steel plate feeder with a capacity of 250 tons per hour, driven by a 5-hp. motor. This feeds the material at a uniform rate to a rotary screen 60 in. in diameter by 20 ft. long, driven by a 20-hp. motor at 20

Tramway double-tension tower designed to transfer buckets from one set of cable spans to another.



r.p.m. This screen separates the material into three sizes, the first section passing everything smaller than 1½ in., the second section taking out all stones ranging from 1½ to 3 in., and the cobbles from 3 to 8 in. discharging at the end of the screen. The last two sizes drop through chutes directly to the storage pile.

The material from the first section of screen is fed to two double-deck vibrating screens through a breeches chute, which contains a baffle gate so arranged that its position will split the supply of gravel into two equal quantities, or in emergency cases the baffle may be rotated completely to shut off the supply to either vibrator so that screening may continue on the other at reduced capacity. The vibrating screens are 4 ft. wide by 10 ft. long and are driven by 7½-hp. motors. The upper screen passes everything below ¾ in. to produce ¾- to 1½-in. size that drops vertically to the storage pile, and the lower screen of ¼-in. mesh separates out the sand and discharges the ¼- to ¾-in. size directly to the storage pile.

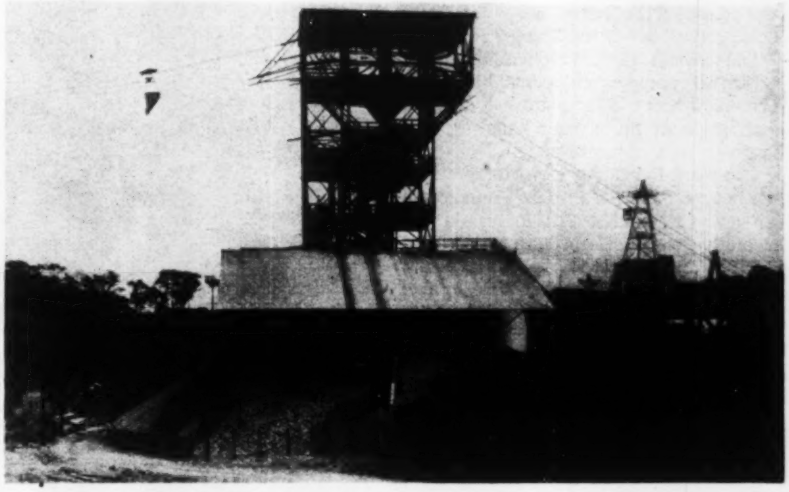
The sand is dropped to a rotary washer that also discharges its product downward to a storage pile. This washer has a capacity of 80 tons per hour and is driven by a 5-hp. motor at a speed of 2½ r.p.m. In addition to the direct washing of the sand, water is sprayed through a 6-in. pipe located on the axis of the rotary screen to wash the larger sizes, and high-pressure nozzles set over the vibrating screens serve to wash the small sizes as well as assist in passing them through the screens.

Gravel storage

The columns that serve as supports for the elevated screening plant offered a simple means of supporting diaphragms that act as separators for the various sizes of gravel. These diaphragms were extended out to conform with the shape of the storage pile and were built of structural-steel framing and filled out solidly with 8x8-in. timbers. The various sizes of gravel thus rest against the sides of the screening-plant structure, with the apex of each pile sufficiently near to the discharge end of the screens to require only short chutes for feeding the products by gravity to the storage bays.

The gravel storage area has a live capacity of about 6,000 cu.yd. of material and a dead storage of 12,000 cu.yd. Each bin was designed with high stress allowances to be stable when empty and with adjacent bins full.

On account of the height of the gravel-plant structure and the heavy pull of the tramway track cables on one side, these cables were extended through the plant down to the ground for anchorage, and the entire structure was separately guyed with a heavy backstay.



Tramway-discharge terminal, screen plant and gravel storage.

A reinforced-concrete tunnel extends under the full length of the storage pile, with chutes and gates feeding laterally from the under side of these piles to a belt conveyor.

Feeding the mixing plant

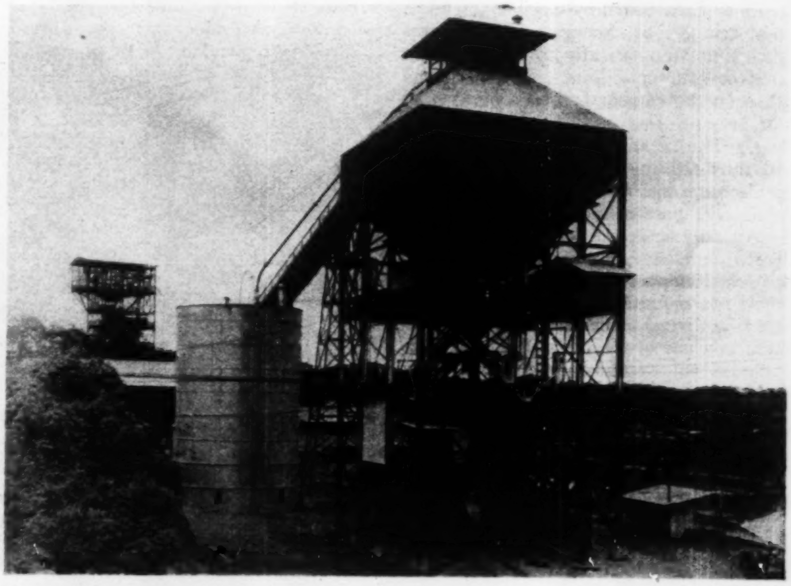
The conveyor to the mixer plant is in two sections, each about 260 ft. long, and is driven by 50-hp. motors at a speed of 250 ft. per minute. The 30-in.-wide belts have a capacity of 250 tons per hour and operate at an angle of 15.5 deg. At the transfer point of the two conveyors a diversion chute is installed to discharge material into a loading bin from which trucks may draw off any size of gravel for use at other points. At the top of the mixer plant the conveyor discharges into a revolving spout to feed the various sizes of gravel into their respective bins.

The feeding to the concrete plant is interlocked with an electric signal system, so that the settling of the spout in the mixer plant illuminates a light under the corresponding size of material in the storage pile. Replenishment of aggregate as needed is thus assured.

Mixer plant

Special consideration was given in the design of the mixer plant to make it readily adaptable to other jobs or for use as a ready-mix plant. The storage bins were designed to contain six different materials on a basis of 1 : 2 : 4 proportion of concrete in sufficient quantity to provide a day's run at full capacity. The watertight cement bin is located in the center portion of the structure, and two sand bins and four gravel bins surround the cement. Considerable study was required to develop satisfactory structural details for supporting the 2,000 tons of material, and still arrange the structural members in sizes for convenient and rapid assembling and dismantling. The structural units themselves were shop-riveted, but all field

Mixer plant and cement silo are constructed of steel and designed for complete salvage.

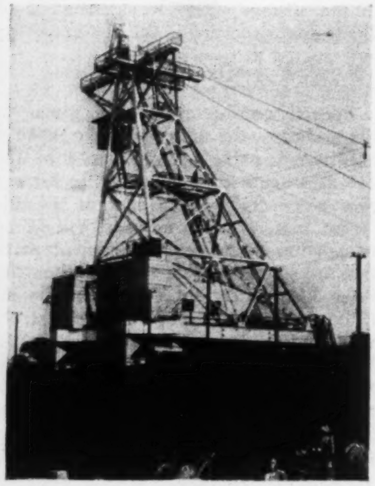


connections were bolted, bolts with self-locking nuts being used.

The cement is delivered to the plant by an air pump from a 6,000-bbl. silo located adjacent to the plant. A detailed description of the cement handling will be given in a separate article.

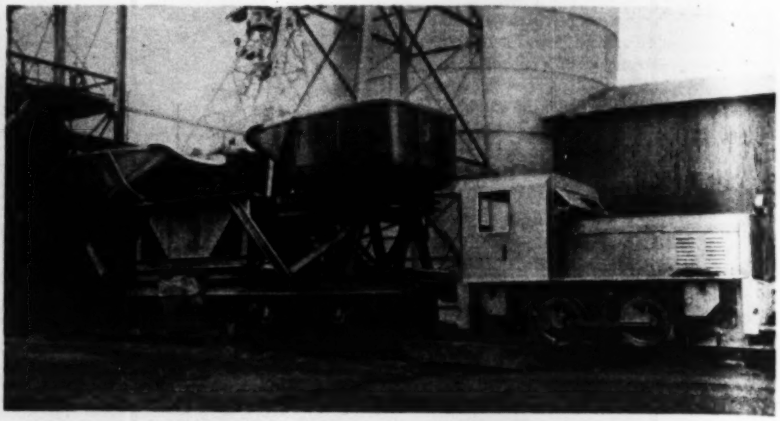
The plant has a capacity of 120 cu.yd. per hour on the basis of a 3-min. cycle for a 2-yd. batch. All materials are carefully weighed through individual batchers and separate scales. The filling of the sand and smaller-size gravel batchers is done manually, but the gate above the cobble batcher is mounted on rollers and operated by air pressure. The cement batcher is filled automatically after being started by an electric pushbutton, and it has a major streamflow, with a final dribble stream that cuts off automatically at the specified weight with very little error. The dumping of the batchers is accomplished from a panel board by electric solenoids that trip the batcher gates, these gates reclosing automatically through the action of counterweights. The discharge gate on the cement batcher operates by air pressure for positive control of sealing. The cement batcher is arranged so that refilling cannot start until the scale beam has returned to zero and the discharge gate closed and locked.

Head tower of 25-ton cableway runs on 450-ft.-long steel trestle across width of dam.



An electric counter records the number of batches. The batchers dump into a single hopper, on the under side of which is mounted a rotating spout that may be turned to deliver the aggregates into any one of the three mixers, a suitable signal system being provided to control the operations on the various floors. An individual water tank is mounted over each mixer, and filling and dumping of this tank is done manually. Chagres River water is used without special treatment.

The three mixers are of 2-yd. capacity, electrically driven by 50-hp. motors, and are mounted radially with their discharge spouts pointed toward the center of the plant for dumping into a single spout to the concrete train below. The mixers are set on an independent timber frame for greater structural simplicity and to eliminate objectionable vibrations in the plant.



Concrete dump cars carry concrete from mixing plant to cableway.

Transporting concrete

The concrete is hauled to the dam within reach of the cableway by two units, each consisting of an 8-ton gasoline locomotive and a special car, on which are mounted two 4-yd. hoppers.

At the point of dumping into the 8-yd. cableway bucket an electric circuit is plugged into the car, and a motor-driven oil pump develops pressure in two hoisting cylinders, causing the two hoppers to be tipped toward each other and to discharge the concrete through a common spout into the bucket. Instead of providing special loading points for the bucket, a trestle was constructed along the full range of the cableway, so that the concrete bucket may be landed at any point. This system has proved very satisfactory and a great time-saver for the cableway.

Cableway

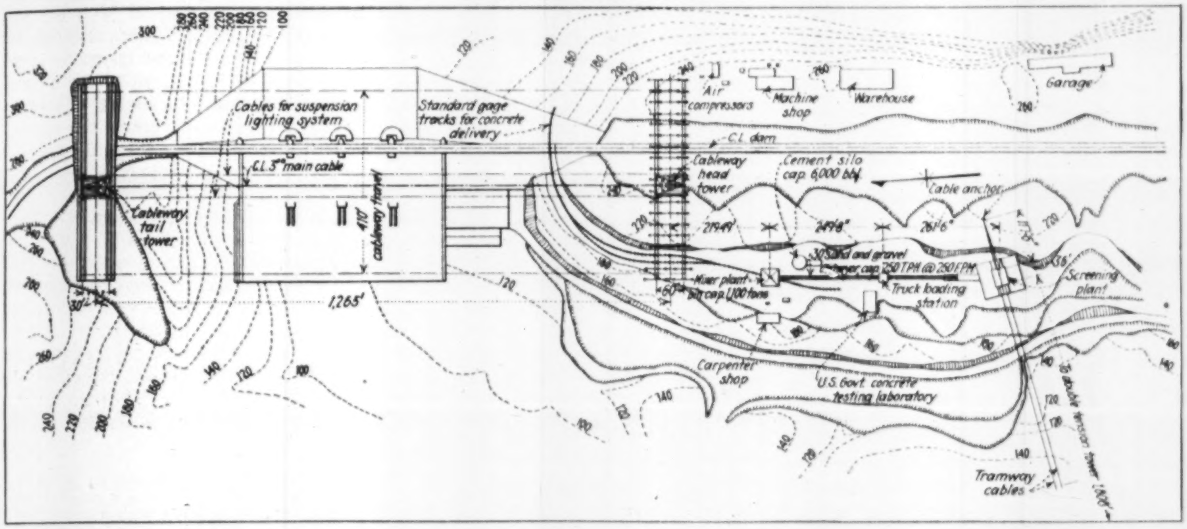
The choice of a cableway for serving the Madden Dam area was based partly on the suitability of the topography adjacent to the area, and also because the speed of construction of the dam was limited by the government specifications allowing not more than 30 ft. of concrete to be placed in any block during a month's period. The cableway covers practically all of the concrete structures with the exception of some smaller pieces of apron at the upstream and downstream ends. Since all equipment and materials for the dam are hauled a distance of 13 miles by truck, a capacity of 25 tons was considered ample to handle the heaviest pieces, and for normal operation the cableway will be required to handle an 8-yd. load of concrete with bucket, weighing about 20 tons, and rock skips with a capacity of 10 cu.yd.

The cableway towers and runways contain numerous new and unique features. Instead of building the common

General view of Madden Dam, showing cableway and concrete plant in distance.

type of temporary timber towers, the present ones were regarded as machines of a more permanent and re-usable type, and all mechanical and structural features were developed accordingly. The head tower travels over the ultimate crest of the Left Ridge Dam on a steel trestle. Special precautions were taken to anchor the trestle footings deep into the rock foundation. The tail tower runway is composed partly of a cut into solid rock and partly of fill from this cut. Additional material for this fill was also taken from the Madden Dam excavation. The top of the fill was graded and surfaced under the rails with concrete slabs in which special provisions were made to compensate for settlement, which in time is expected to be 12 in.

Map showing general layout of construction plant and Madden Dam area.


Cables for suspension lighting system
Standard gage tracks for concrete delivery
C.L. 3" main cable
Cableway tail tower
410' cableway travel
1,265'
30'
C.L. dam
Air compressors
Machine shop
Warehouse
Garage
Cableway head tower
Cement silo cap. 6,000 bbl.
Cable anchor
219'4"
249'8"
261'6"
30" sand and gravel conveyor cap. 250 TPH @ 250 FPM
Mixer plant bin cap. 1,100 tons
60'
Truck loading station
Screening plant
36'
Carpenter shop
U.S. Govt. concrete testing laboratory
To double tension tower 1,870'
Tramway cables

One of the most noteworthy features of the towers is the introduction of horizontal wheels at the rear to take the entire cable reactions. Thirty-two wheels take the vertical load of each tower, with full equalizing of load within each group of wheels. The best crane practice was employed in the design of the trucks and wheels. While it has been common experience heretofore to break quite a number of wheels during the period of a job, no breakage has occurred during the first six months of operation, and it is very unlikely that with the present arrangement such failures can occur.

The structural brackets in the rear of the towers support the counterweights at a point where their function is most effective. The counterweights consist of precast reinforced-concrete slabs weighing 4 tons each.

During the early stages of the design of the towers, announcement was made of the newly developed rivet bolt, a patented bolt with a superior self-locking thread and fluted shanks, the outside diameter being larger than the hole, so that on driving the bolts with a heavy hammer the shanks deform and produce a tight fit to improve the shearing resistance of the bolt. Through the cooperation of the Bethlehem Steel Co. a series of tests was made in its laboratories to determine the value of this type of bolt in a multiple-rivet joint as compared with hot-driven rivets. It was found that these bolts produced a joint which in all respects was as satisfactory as a riveted joint, and their use was adopted for the cableway towers. The erection with this type of bolt was greatly simplified, and the dismantling will be considerably easier and leave the structural members in better condition than is obtained from burning off and backing out hot-driven rivets. The use of these bolts on this first major installation was described in *Engineering News-Record,* May 19, 1932, p. 740.

Each tower is 100 ft. high and travels on two pairs of rails 60 ft. between centers of each pair, and 8 ft. between centers of rail. Traversing of the towers at 66 ft. per minute is accomplished with the usual system, consisting of a 100-hp. endless drum mounted on the tower and three parts of cable extending on each side to the ends of the runway where the dead ends are looped over sheaves to counterweights. The track cable is 3 in. in diameter, of lock-oil type, and the present installation represents the first use of this large-diameter cable. Similar cables are now being manufactured for the Hoover Dam project. The span is 1,325 ft., and when carrying a maximum load of 35 tons (dead plus live), under a deflection of 5 per cent it will be stressed up to 425,000 lb.

The mechanical installation on the cableway is of the latest design, with remote-control equipment. The carriage is in two parts and contains twelve track wheels spaced 33 in. on centers, providing a wide distribution of load on the main cable. The hoist consists of a two-drum unit with an auxiliary drum for handling rock skips and is driven by a 400-hp. motor of the induction type. The carriage travels at a speed of 1,200 ft. per minute between the two towers, and the load travels vertically at a rate of 300 ft. per minute.

For excavating, 10-yd. rock skips designed for cableway dumping are provided. The concrete bucket was designed by the writer and built in the Balboa shops of the Panama Canal.

Illumination is provided by two strings of 100-watt reflectors suspended across the canyon on lateral extensions at the top of the towers. The power supply for the tail-tower system also extends across the valley on one side of these extensions, and a signal cable is similarly supported with taps at various intervals between the towers, and hangers extend down to the rock so that telephones may be plugged in for direct communication with the operator, who is located in a cab near the top of the head tower.

Direction

The Madden Dam was designed by the Bureau of Reclamation for the Panama Canal and is being constructed under the supervision of the Canal Zone administration, including Julian L. Schley, governor; Colonel C. S. Ridley, engineer of maintenance; and Major J. C. Mehaffey, assistant engineer of maintenance. E. S. Randolph, construction engineer, is in direct charge of the work; I. E. Burks is chief concrete technician, and A. W. Brooks is engineer of the dam.

For the contractors Paul Grafe is managing director, and R. M. Conner is general superintendent. The general features of the construction plant were defined by M. H. Slocum and L. D. Crawford. The structural and mechanical design, as well as the fabrication and erection, were carried out under the supervision of the writer.

Experiences in Operating Dunbar Sewage Filters

Early overloading of treatment plant and acid condition of sewage cause operating difficulties

By H. L. Thackwell
Consulting Engineer, Tyler, Tex.

AN ACID condition of the sewage at the Tyler, Tex., sewage treatment plant caused by the infiltration of acid groundwater into the collecting system, occasioned great difficulties in plant operation. Overloading of the plant due to the rapid increase in population further complicated the operating problem. Close technical supervision in correcting the acid condition was necessary to bring about a satisfactory performance. In addition to these unusual experiences, valuable observations have been made on the operation of Dunbar filters, a type of filter that has rarely been used in recent years.

When the plant was completed in November, 1930, the population was 17,000, but the oil boom of 1931 doubled the population in six months. The plant was designed for an average flow of 0.6 million gallons daily (m.g.d.) and a maximum of 1 m.g.d. Doubling the population, therefore, produced a 10 to 50 per cent overload. The plant is now operating satisfactorily but is being enlarged by the construction of a new unit that will add 1 m.g.d. to the plant capacity.

The plant as completed comprises a head house, which houses sluice gates for shutting off the sewage flow, a small grit chamber, a vertical cage bar sceen, two automatic flow regulators, a recording weir and a hydraulic jump to break up the solids. A chlorinator of the vacuum type is provided for pre-chlorination. Following chlorination, the sewage flows to a multiple-hopper-bottom settling tank designed for a normal flow of 0.6 m.g.d., with a retention period of 1½ hours. The scum and sludge from this tank are removed to separate sludge tanks. The settled sewage flows to a primary Dunbar filter of three units, having a combined area of 30,000 sq.ft. (The Dunbar filter is essentially a slow-sand filter, which in operation is flooded with sewage until clogging occurs. The clogged filter is allowed to dry and is then scraped, the settled sewage in the meanwhile being diverted to another filter unit. After scraping, the bed is ready for another dosing.) The effluent from the primary filter is carried to a secondary Dunbar filter, also of three units, having a total area of 15,000 sq.ft. The effluent from this filter is discharged over a step aerator and flows into Black Fork Creek.

The sludge from the settling tank is conveyed to circular separate sludge-digestion tanks, which are provided with heating coils and agitation devices. The tanks are also arranged for suction degasification and gas storage. Inspection may be made through glass portholes. The interior is lighted by marine lights. Patents have been applied for on these digesters. The digested sludge is dewatered on a glass-covered drying bed of four compartments.

When the plant was first started up it was observed that the incoming sewage was quite acid, having a pH of 6.2 to 6.8, although such a condition had not been observed in the operation of the old plant which had been located at another site. Settling-tank operation was handicapped as the acid sewage did not settle readily. A portion of the lighter particles always stayed on the surface or, in some cases, floated at middle depth between the scum and the sludge. Also sludge digestion was inhibited by the acid, carbon-dioxide-producing bacteria increasing and methane-producing bacteria decreasing. The raw-sludge analysis showed a pH of 5.9; solids, 1.95 per cent; ash, 22.6 per cent. Partly digested sludge had a pH of 5.6; solids, 23.5 per cent; ash, 50.9 per cent. Further, sludge drying was retarded. The sludge developed a leathery surface and tended to breed flies. The Dunbar filters clogged early, a gluey coating forming on the surface, which would not permit the sewage to filter at the customary rates. The overloading of the plant aggravated the situation.

A chemical study of the plant operation during the period of high acidity was made by P. J. Zeller, chemist of the Texas Sewage Experiment Station, and by Prof. E. W. Steel, of the Texas Agricultural and Mechanical College. They found that even under the conditions of overloading the settling tank was efficient, removing 61.5 per cent of the suspended solids and 50.0 per cent of the oxygen consumption. But because of the large volume and high acidity the load was too great for the filter. The primary filter bed removed half of the suspended solids remaining in the sewage after sedimentation. The removal of solids by the filters had been lowered sharply when the volume load had become too great and the oxygen-consumed values showed the same trend.

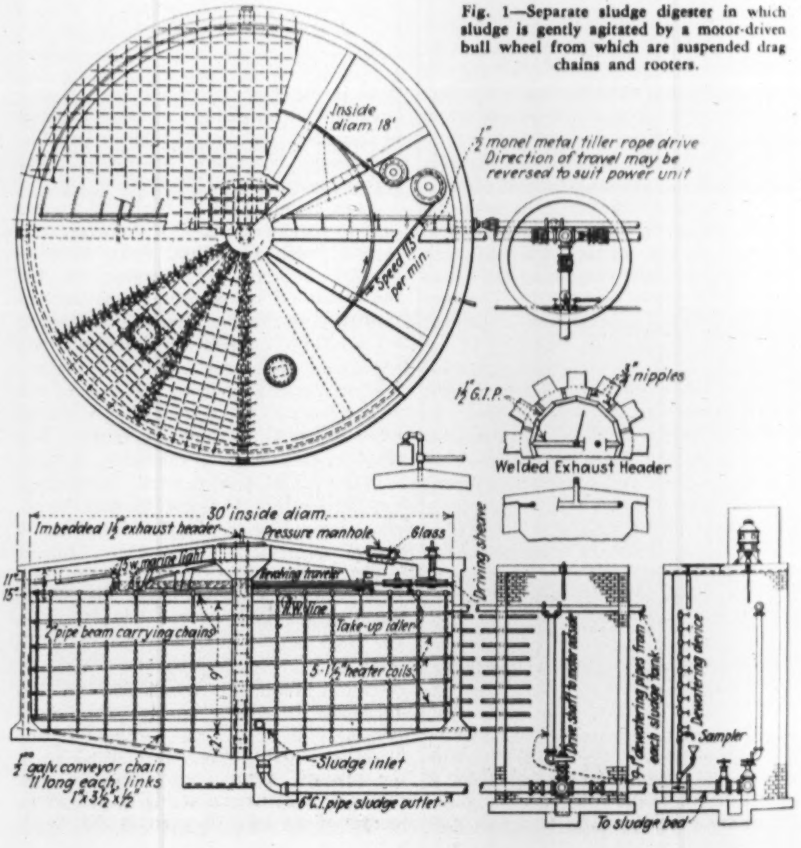


Fig. 1—Separate sludge digester in which sludge is gently agitated by a motor-driven bull wheel from which are suspended drag chains and rooters.

The secondary bed showed little removal of suspended solids or oxygen consumed. It did, however, introduce dissolved oxygen into the effluent. The entire plant removed 82.7 per cent of suspended solids and 61.1 per cent of the oxygen consumed.

To discover the cause of the acidity, the writer made a survey of the pH, carbon dioxide and hydrogen sulphide content of the sewage at frequent points along the 3-mile-long outfall sewer and throughout the collection system. The survey showed that the acidity was due to groundwater infiltration, the groundwater itself being highly acid and entering the system in considerable volume. The trade wastes collected by the system, however, were found to have a net tendency to reduce this acidity, the highly alkaline laundry wastes more than neutralizing the acid milk and creamery wastes. It was noted that the waste waters from the negro districts are highly alkaline because of the large amount of laundry work done in the homes there. All surface waters and the city tap water were found to be alkaline. There was practically no infiltration found in the outfall sewers, nor were the five siphons found to be collecting sludge or causing hydrogen sulphide production.

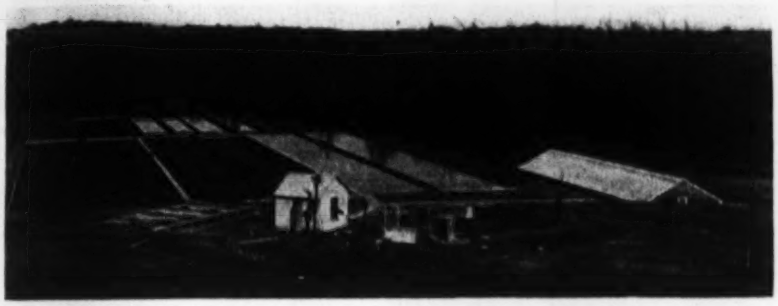


Fig. 2—Tyler sewage-works has primary and secondary Dunbar filters (background), a glass-covered settling tank (left of house) and circular sludge-digesting tanks.

It was concluded that any corrective measures would have to be made at the plant. Aeration by means of compressed air, together with lime treatment, was found to be the most effective and economical method.

The conditions seemed favorable for the use of the lime in connection with sedimentation. Accordingly, lime was fed into the 24-in. outfall sewer a short distance above the plant. Sedimentation was improved thereby, and amino-purine odors were reduced. Sludge digestion was accelerated by further lime adjustment and by reseeding with alkaline sludge brought from Lufkin, Tex. Methane gas production increased rapidly, and the sludge dried readily. Some improvements were also noted in the filters, the rate of filtration being somewhat increased. Odors were reduced to a minimum.

Observations made during the period of operation of the Tyler plant show that all the sewage odors encountered are not derived from hydrogen sulphide. Frequently odors are due to small volumes of volatile amines and mercaptans.

REMOVAL OF SUSPENDED SOLIDS AND OXYGEN CONSUMED BY VARIOUS UNITS

	Suspended Solids, Per Cent	Oxygen Consumed, Per Cent
Settling tank	61.5	50.9
Primary filter	48.3	22.1
Secondary filter	12.8	8.8
Total plant	82.7	65.1
Settling and primary bed	80.2	61.7

The hydraulic jump shatters all the sewage solids and washes out contained gases. Mixing is complete, permitting highly accurate sampling of the raw sewage.

The centrifugal trash pumps handling the raw and digested sludge give no difficulty as long as there are no large screenings to handle and the solid content of the sludge is not greater than 10 per cent.

It has been found that the Dunbar beds start filtration with a fairly high-colored effluent, but on clogging nearly all color is removed due to its adsorption in the colloidal mat on the surface of the filter. The rate of flow from the various outlet channels varies with the clogging over the surface of the sand. The lower the flow from the channels the clearer the effluent becomes, but the oxygen-consumed value may be the same for both clear and colored effluent. The slope of the angle of percolation from the sand surface through the rock to the effluent channels is about 2 to 1. Sludge does not penetrate into the sand to a depth greater than 6 in. A mat, $\frac{1}{16}$ in. thick, is left on the surface of the sand, which curls up on drying and can be removed easily with a shovel. The dried mat should be removed and burned or placed in fill. It has an odor but of a type that is not usually migratory.

The depth of sand may be reduced to 9 in. through successive cleaning without seriously affecting the treatment. The biological process is largely carried on in the rock or gravel layers, the sand layer serving as a strainer and supporting medium for the colloidal mat which acts as the true filter. The rate of filtration varies with the character of the sewage, depending largely on the removal of settleable solids by the sedimentation tanks. Oxygen is dissolved in the early period of filtration but is exhausted upon clogging or filtering with high rates. Secondary filtration removes the slurry that usually is discharged from the primary filter, but the reduction in oxygen consumed is not as great as might be expected.

Final settling tanks are unnecessary with Dunbar beds. The head required to operate them is about 40 per cent of that utilized for trickling filters. The beds do not breed moth flies, snails or worms. When not overloaded the reduction in biochemical oxygen demand has been about 66 per cent through the filter.

Operating costs for Dunbar filters in the climate of east Texas may be estimated as the cost of one laborer per acre of surface area and the replacement of 2 in. of sand per year. An even grading of the sand from 30-mesh to ¼ in. has proved satisfactory

The final aeration of the sewage over a step aerator on the average has increased the dissolved oxygen content 0.5 parts per minute. The aerator comprises a drop of five steps with a total fall of 2 ft.

The Tyler plant was designed by the writer, who was also retained by the city to investigate the acid condition of the sewage and to devise corrective treatment. The plant was constructed by W. B. Carter, contractor, and the construction was supervised by J. P. Ferril, city engineer, and Lee Powell, city manager.

◆

Extra-Wide Road Mileages

A total of 3,790 miles of state roads wider than two traffic lanes is reported by the Bureau of Public Roads in its issue of *Public Roads* for November, 1932. The figures are as of Jan. 1, 1932, and include 2,230 miles of three-lane, 1,385 miles of four-lane, 83 miles of five-lane and 92 miles of six-lane roads. Only state-system roads are counted, excluding city and park roads and generally all but rural highways. The excess of three-lane over four-lane roads is very largely accounted for by the figures from the state of New York, which reports 914 miles of three-lane roads and only 185 miles having four lanes. Illinois, in contrast, has only 7 miles of three-lane roads and 251 miles with four lanes. Only 174 miles of roads has been built more than four lanes wide. Of four-lane roads having the pairs of lanes separated by a parkway or other barrier there was only 84 miles, of which 23 miles was built in 1931. Of the 3,790 miles of existing extra-wide highways, 1,008 miles was built in 1931. Of this total, 388 miles was of three-lane, 600 of four-lane, and 20 of greater than four-lane width. The trend is toward four-lane rather than three-lane highways, and designs involving more than four lanes are not finding much favor at the present time.

Girderless Concrete Slabs Solve Headroom Problem

Lackawanna Railroad solves troublesome headroom problem and cuts yard fill 100,000 cu.yd. by using column and flat-slab construction for overstreet crossings at Elmira, N. Y.

By M. Hirschthal

Concrete Engineer, Delaware, Lackawanna & Western R.R., Hoboken, N. J.

GRADE-CROSSING elimination practice has been considerably modified by the recent adoption of the girderless flat slab for individual bridge crossings. This change is due to the great economy in the bridge itself, and, considerably more, to the fact that a greatly reduced floor depth results, thus reducing the difficulties in modifying the track profile—generally the greatest single problem in grade-elimination projects.

These facts are well exemplified in the Elmira, N. Y., grade-elimination project of the D.,L.&W. Railroad now in progress, where the selection of this type of design for all the overstreet crossings solved the difficult problem of track grades in the vicinity of an extensive yard. As a result, the maximum rise in a track revision extending over a distance of more than 2½ miles is only 12 ft. despite the fact that the depressions at the various streets were found to be limited because of the comparatively high water level resulting from the proximity of Newtown Creek and the Chemung River.

The improvement begins east of the Newtown Creek, Fig. 1, the track rising on a .3 per cent grade to Church St., from which point it runs level to Sullivan St., ascending on a .133 per cent grade to Lake St., whence it descends on a .19 per cent grade to Washington Ave., continuing on a .3 per cent descending grade into the yard, a total distance of about 2½ miles, of which ½ mile is in the yard itself.

The operation includes the raising of a two-track through-truss steel bridge over Newtown Creek; the construction of an overhead highway viaduct at East Water St.; undercrossings at East Church St., Sullivan St., Madison Ave., Lake St. and East Washington Ave.; retaining walls and fill between these streets, and bypasses from Clinton to Sullivan Sts., from East St. to Oak St. which joins Lake St., and from Dickinson St. to Baldwin St. which joins Washington Ave.

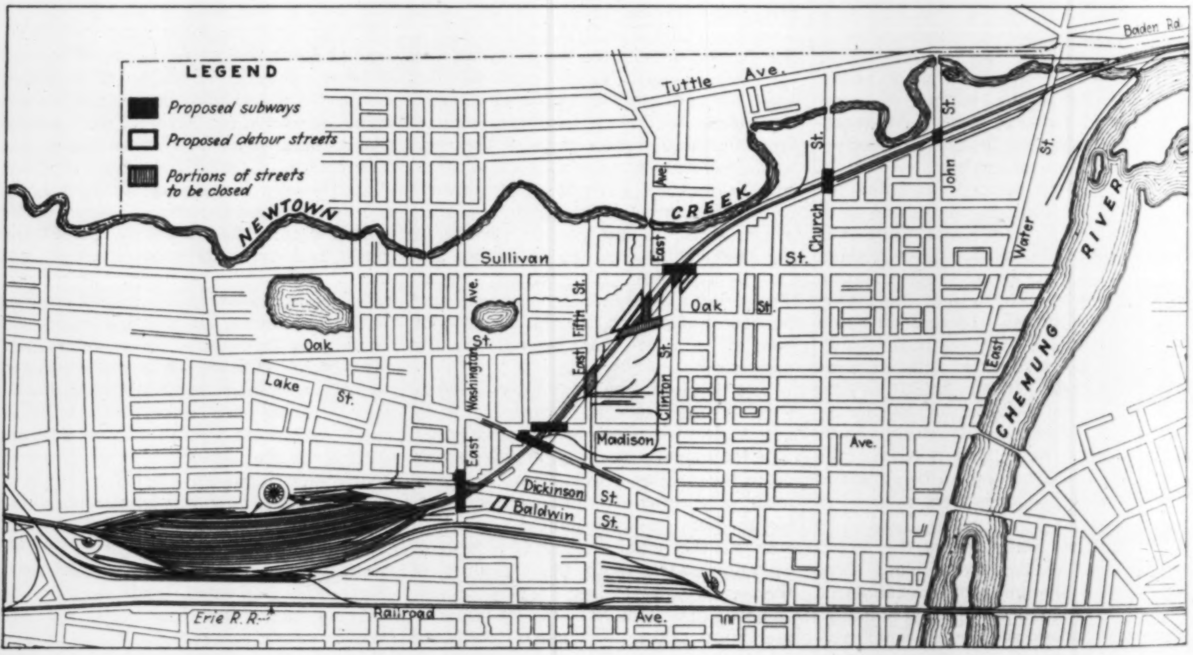
In addition there are provided a new island platform and canopy extending from Lake St. to Washington Ave. with shelter houses, as well as a sleeper platform adjoining a new two-story service building to be constructed at the end of a combination baggage and passenger subway. From the present passenger station, which is retained because of its excellent condition, a passenger subway leads to the island platform.

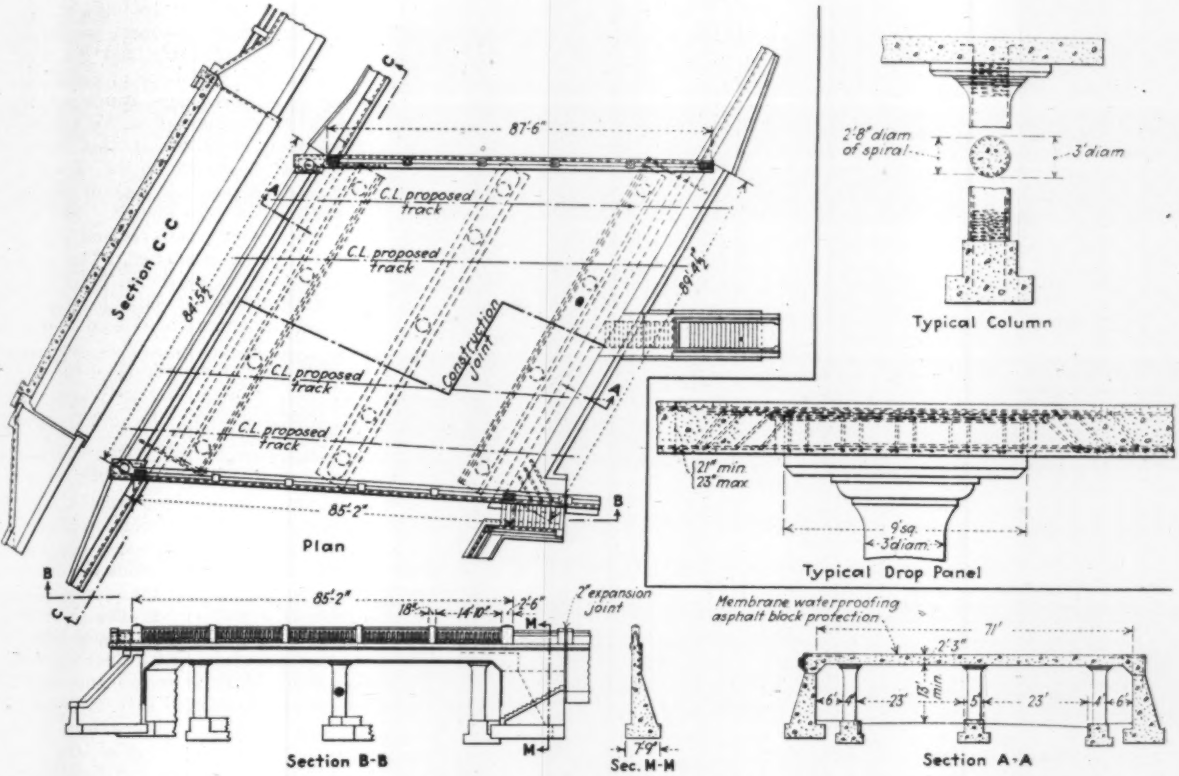
By agreement with the city it was possible to close John, Clinton, East, East Fifth and Dickinson Sts. by providing diverting highways to streets adjacent to them which had access across the railroad tracks as above outlined.

Design of structures

As soon as the general project of the grade-crossing elimination was agreed upon by the city of Elmira, the state departments and the railroad, it was decided to build the East Water St. overhead highway viaduct (the only overhead structure) in advance of the other construction so as to have clear sailing for the remainder of the structures. The reason this structure was made an overhead viaduct is because of the close proximity of Newtown Creek, which limits the depression in the street possible at this location. This bridge, completed more than a year ago, consists of a structural-steel through-girder span over the proposed four tracks of the railroad with a reinforced-concrete two-way slab and girder span on each side except over Newtown Creek, where two 48-ft. spans of reinforced-concrete T-beam construction were used. The structure provides a 36-ft. roadway and a 6-ft. sidewalk cantilevered from one side, resulting in nearly square (36x34-ft.) panels. However, due to the fact that East Water St. joins Tuttle Ave., a through highway running into Baden Road, there was required a widening of

Location of street-crossing structures in grade-crossing elimination at Elmira, N. Y., by the Delaware, Lackawanna & Western Railroad.





Overstreet crossing at Washington Ave., showing typical flat-slab structure without drop-panels; inserts show column and slab construction at Sullivan St. crossing. Drop-panels are used on all but two bridges.

the roadway on the curve, so that two panels in width were required as against one for the remainder of the structure. Due to the curvature a sharp superelevation in grade was provided for the panels on the curve, further complicating the details.

All the undercrossings are of the girderless flat-slab type, with or without drop-panels as the individual conditions required. Drop-panels were omitted at East Church St. and East Washington Ave. but were provided at the other streets, since drop-panel construction is more economical despite the slight additional formwork required.

The advantage of this type of bridge is forcibly illustrated in the case of the structure at Washington Ave.—the most westerly street affected by the elimination. West of this street is located the Elmira freight yard, about 40 tracks in width, necessarily limiting the approach grade to the bridge for economic freight operation. This limiting grade is 0.3 per cent.

With the depth of possible street depression fixed, it was necessary to elevate the track the amount necessary for clearance and floor depth. Each inch of additional rise in track level meant 6,000 cu.yd. of additional fill for the freight yard. With columns 28 ft. c. to c., a one-way slab continuous over the supports would be 3½ ft. deep unless heavy compressive reinforcement were used, whereas for the four-way slab without drop-panels (the city desired the omission of the drop in this street to provide maximum clearance) a 2¼-ft. slab is required. This reduction of 15 in. in floor entails a reduction of about 100,000 cu.yd. in the required fill in the yards as well as the shortening by more than 400 ft. of the length of freight yard affected, all this aside from the intervening fill and height of retaining walls between streets. The selection of this four-way type was thus amply justified.

Washington Ave. and Church St. bridges are both designed for a 71-ft. width of street providing two 23-ft. clear driveways and two 10-ft. sidewalks resulting in a 28-ft. c. to c. spacing of the 3-ft. diameter columns, measured at right angles to the street center line.

The angles of crossing of the two bridges are somewhat different as is also the arrangement of tracks. At East Church St. the angle is 66 deg. 17 min. and the four practically level tracks are parallel; this condition requires a slab 2⅓ ft. thick at the center and 2 ft. 2 in. thick at the edges for drainage, for a transverse center-to-center column spacing of 24 ft. 8 in. East Washington Ave., beginning at the west end of the island platform, involves a separation of the tracks with different angles at the two faces and of course a greater width of bridge. The transverse column spacing is 22½ to 24⅓ ft., and a 2¼-ft. uniform thickness of slab satisfies the conditions, including drainage, which the grade of track provides at this point.

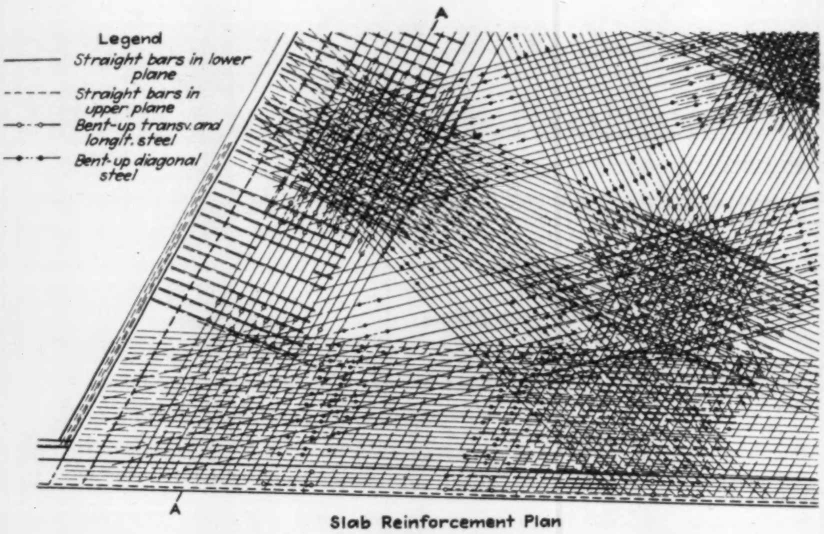
Lake St. at the other end of the island platform is provided with the same street width of bridge as the two above described, resulting in identical column spacing in that direction, but because of the 10-in. drop-panel thickness requires a slab thickness of only 2 ft. 1 in. at the center and 1 ft. 11 in. at the edges, the transverse section of bridge being complicated by the separation of tracks similar to that of Washington Ave.

It was decided to make Sullivan a 66-ft. street with two 20-ft. clear driveways and 9½-ft. sidewalks resulting in a 24-ft. c. to c. spacing of the 3-ft. columns. The angle of crossing here is sharper (48 deg. 24½ min.) with four parallel tracks on a 2 deg. curve.

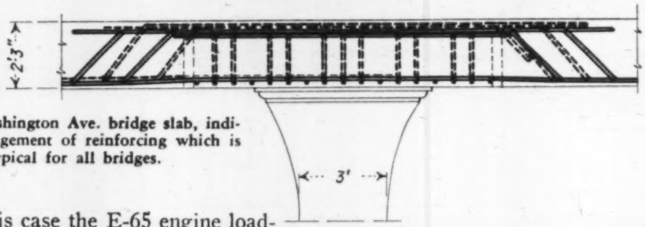
With a 21½-ft. column spacing along the street line and a 10-in. thickness of drop-panel, a slab 1 ft. 11 in. thick at the center, tapering to 1 ft. 9 in. at the edges, meets the requirements.

At Madison Ave. a 67-ft. street width is provided, with columns spaced 23 to 24 ft. along the street line and 26 ft. in the other direction. The four tracks at the bridge have not yet become parallel so that the two faces form different angles with the street center line. The 10-in.-thick drop-panel permits a uniform thickness of slab of 2 ft., drainage being provided by the grade of the tracks at this location.

Besides providing a problem in column spacing the skew crossings also presented that of the distribution of live


Legend
Straight bars in lower plane
Straight bars in upper plane
Bent-up transv. and longit. steel
Bent-up diagonal steel
A
A

Slab Reinforcement Plan



Section A-A

Part of Washington Ave. bridge slab, indicating arrangement of reinforcing which is typical for all bridges.

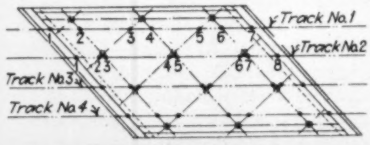
load (in this case the E-65 engine loading) among the various bands of the flat slab. As far as the column spacing is concerned, a skew of 45 deg. provides the most satisfactory spacing, resulting in square panels with the fascia panels cut in half as triangles, or really three-way slabs. Variations from that angle result in irregular column spacing.

The method of application and distribution of live load, or the engine loading, presented an interesting and a possibly complicated problem. The writer decided that inasmuch as five bridges with varying skews were involved it was best to compare two indicated methods of procedure, and if the variations were slight to take the simpler of the two and apply this method to all the bridges. The bridge selected for this was the one at Sullivan St. Referring to the diagram, the engine loading was first spotted on track 1, and supports were considered as located at points 1, 2, 4, 6 and 7; various maximum moments for different conditions over these continuous spans were obtained as well as the equivalent uniform live load corresponding to these moments. The same procedure was followed for tracks 2, 3 and 4.

The other method was that of considering the track supports at the center lines of both of the main bands so that each track would have supports at all the numbers indicated on the figure. The moments and corresponding uniform loads for this assumption were then found. A comparison of the results proved that the difference was negligible so that supports at the transverse lines of columns only were assumed as acting for the purpose of obtaining the equivalent uniform live load.

The next step was to find the moments in each set of bands. The track centers being 13 ft., the live load was considered distributed over that distance. The transverse bands were considered loaded with one-quarter width of load from the panels on each side of the center line and treated as a beam continuous over the four columns, and moments figured for loadings on each of the tracks successively and the maximums found. The same procedure was followed for the main bands at right angles to these, as well as for the diagonals, each of which in this instance were of equal length in the two directions and carried one half of the load allotted to the middle half. The dead load is of course uniform and continuous and was thus treated. The impact allowance is on the usual basis of the relationship between dead and live load. The resulting moment due to the dead load, live load and impact was then reduced for the shortening of the spans due to the column flare and capital, and the reinforcement, etc., were figured accordingly.

Diagram illustrating procedure in computing slab stresses.



Construction details

To facilitate the construction of all these structures in the clear without interference with traffic, the temporary tracks together with industrial sidings were located south of the proposed construction beginning at the Newtown Creek bridge, requiring trestle bents at the various streets and a temporary station south of these tracks and west of the present station. This diversion of tracks permits the completion of all the construction except that of the south wing walls of Sullivan and East Church Sts. before tracks are shifted to the new elevation.

Another interesting operation was the raising of the present Newtown Creek bridge, the span of which is 142 ft. 11 in. c. to c. of bearings and which is on a skew of about 60 deg., so that floor beams bearing on the masonry had to be jacked up as well as the bearings of the trusses. The grillages for the space between the masonry and the new elevations at the four bearing points were designed to be set in lifts equal to each tier of I-beams, 8, 9 or 10 in. in depth, depending on the required depth at each bearing, which varies from 2 ft. 10 in. to 3 ft. 6 in. total because of the track grade. Each tier of beams constitutes

Formwork for Sullivan St. crossing, showing slab reinforcing being placed.

a raise, a base plate and top plate being provided for each grillage and welded to the edge of flange of the outside I-beams. When the raise had been made these grillage as well as those for the floor beams were completely incased in concrete. The concrete back walls were also raised to the new elevation, temporary approach-trestle bents being provided to complete all this work under traffic.

The work entailed the use of 25,000 bbl. of cement for 15,000 cu.yd. of concrete, part of which is reinforced with over 1,000,000 lb. of steel rods, as well as of 450,000 cu.yd. of fill and 250,000 lb. of structural and other steel. All the undercrossings and subways are waterproofed with a two-ply membrane of asphalt-saturated cloth and are protected against puncture by ballast. The backs of abutments and retaining walls are waterproofed by two applications of emulsified asphalt, the second coating containing asbestos fiber.

Both design and construction are under the general direction of G. J. Ray as chief engineer, the design of the structure being carried out under the supervision of J. L. Vogel, bridge engineer, the writer and D. T. Mack, the railroad architect. The construction is under the supervision of D. R. Young, division engineer of the Buffalo division, with H. W. Machemer as resident engineer in charge of construction. The Walsh Construction Co. is the general contractor, and the John Cunningham Contracting Co. is the building contractor.

Code of Bidding Proposed for Construction

Reporting at the meeting on Oct. 12, 1932, of the policy committee of the Construction League of the United States, the committee on code of practice presented a preliminary draft of a code of rules grouped as (1) rules of trade practice and (2) rules of bidding practice. The rules of bidding practice, of most direct interest to contractors and agencies awarding contracts, are as follows:

A—The issuing of incomplete plans and specifications for competitive bidding that prevent competent bidders from estimating accurately the amount and quality of materials and labor is condemned by the industry.

B—The industry favors the adoption of the following rules in calling for bids:

1. In all cases where competitive bids are requested, no one should be invited to bid to whom the contract would not be willingly awarded in the case his bid is the most acceptable in itself.
2. Where accurate estimates, sketches, designs or plans are desired for information only, a reasonable fee or fees should be paid to the parties preparing them.
3. Invited bidders, provided they actually submit bids, should not be required to pay for the use of plans and specifications.
4. A definite closing time and place should be set when calling for bids.
5. Sufficient time should be allowed for preparation of bids.
6. Qualified bidders are the only ones who should be invited to bid.

C—After a set of competitive bids is received, to reject them and request new bids on the same plans and specifications within a period of 90 days, unless at least 10 per cent of the amount of labor and/or materials is made in revisions, and/or unless the final bidding is restricted to the three lowest and best bids, is condemned by the industry.

D—In competitive bidding on a lump-sum basis the industry condemns the practice of any bidder taking a contract on a cost-plus or fee basis with a guaranteed limit of cost other than his lump-sum bid.

E—For any one receiving bids by invitation to place himself in competition with any or all the bidders is condemned by the industry.

F—To refuse to accept an award within 30 days after closing time for filing of bids is a practice condemned by the industry.

G—The practice of financing or guaranteeing accounts of general contractors by subcontractors, or subcontractors by general contractors, is detrimental to the best interests of the entire construction industry and the building public and is condemned by the industry.

H—To delay payment for work or material when due is condemned by the industry.

I—Where a bidder requests an interpretation of some feature of the plans and specifications from the buyer or his representative before submitting his bid, which would materially affect the cost of the work, the same information should be submitted to all other bidders by the buyer or his representative.

J—The inducing or attempting to induce anyone receiving competitive bids to reveal to a bidder the amounts and conditions of any bid received on a competitive job, with a view to giving the favored concern an opportunity to meet or cut below the lowest bid, whether the favored concern was one of the original bidders or not, is condemned.

K—To mislead or deceive any bidder as to the amounts and conditions of other bids or with any other false information for the purpose of inducing him to cut his own is condemned by the industry.

L—Surreptitiously obtaining information relative to competitors' bids in the preparation of one's own bid is condemned by the industry.

M—The industry approves of the "one-bid" policy and condemns fake or fictitious bids made for the purpose of deceiving competitors and securing undue advantage. If plans and specifications are changed and new bids called for after the original bids have been submitted and opened, the same fairness should obtain as with the original bids.

N—It is a frequent practice for subcontractors to submit bids to general contractors, who in turn use the lowest acceptable price from the several trades in making up their bids on general contract, then reopen the bidding for the same operation, commonly known as "shopping," which practice involves deception and misrepresentation, lowering the standard and quality of material and labor. Such practice is condemned by the industry.

O—Furnishing free professional services whether by the architects, engineers, manufacturers, jobbers or others is condemned by the industry.

P—It is the judgment of this industry that an accurate knowledge of cost is indispensable to intelligent and fair competition, and the adoption of accurate methods of cost-finding and estimating is recommended by the industry.

Q—The industry approves the practice of handling disputes in a fair and reasonable manner, coupled with a spirit of moderation and good will, and every effort should be made by the disputants themselves to arrive at an agreement. If unable to do so, they should agree, if possible, upon arbitration under some one of the prevailing codes.

R—A committee on trade practices is hereby created to cooperate with the Federal Trade Commission and to perform such acts as may be proper to put these rules into effect.

Ten States Complete Map

Topographic mapping of ten states, District of Columbia, and of Hawaii, is now complete, according to the annual report of the Geological Survey. In other states the percentage completed ranges from 8 in Florida to 88.9 in Virginia. Of the continental United States, exclusive of Alaska, 4.5 per cent has been mapped. During the past fiscal year the mapping work done by the survey covered nearly 26,000 square miles.

Housing a Laundry in A Modern Building

Cantilever walls and continuous windows meet laundry needs of maximum daylight and ventilation—Reinforced-concrete building in New York is prototype of much larger Starrett-Lehigh Building—Two lines of columns hung from girders in roof

MODERNIZATION in industry as a means of securing economies that will permit lower and at the same time profitable selling prices is exemplified by the new plant of the Cashman Laundry Corp. in the Bronx, New York City. With building and equipment incorporating the latest developments available for efficient, economical and sanitary operation, the company is able to undersell many of its competitors by as much as 50 per cent and still show a profit, it is claimed. The building itself, to which this article is largely devoted, was designed for an abundance of fresh air, sunlight and cleanliness, and its structural layout was so arranged as to serve equipment and operating needs to best advantage. Features of the building, which is of reinforced-concrete flat-slab construction, include cantilever walls permitting continuous window-sash, a group of three-story concrete columns hung from concrete girders in the roof and notched expansion joints in the faces of the concrete spandrels. Floors are hard-finished, and all areas where water is abundantly used are pitched toward large self-draining quick-emptying outlets.

In planning the building, several definite objectives were set up: It had to be constructed within economical limits; it had to be symbolic of cleanliness and simplicity; it must be unique and different enough from other buildings to have definite advertising value; and all features of the interior design must be such as to permit efficient operation and low operating and maintenance costs. With the building completed and occupied for several months, the owners believe these objectives have been achieved.

The building occupies a site 267 ft. long, varying in width from 99 to 111 ft. It is three stories (about 50 ft.) high, with a tower in the center (95 ft. high above the street) in which is included a fourth floor utilized for a cafeteria and a tank floor above. The ground floor, with boiler and engine rooms in a basement at the northwest corner, accommodates receiving and dispatching facilities, wash room and general offices, and covers the full plot area. The second and third floors, in which the finished laundrying operations are concentrated, cover the entire plot length but have a width of only 95 ft., thus maintaining a permanent light court along the rear building line. A ceiling height of 14 ft. is provided for all these floors. The fourth or tower story is 45 ft. wide by 76 ft. deep. The tank floor is about 45 ft. square and is not roofed over. The plant has a total floor area of 81,600 sq.ft. and a capacity for handling $50,000 worth of business per week.

In basic design the building follows closely the Starrett-Lehigh Building (*ENR*, July 7, 1932, p. 1). The laundry owners, in fact, were attracted by the outside appearance of that structure, and sought out its architects for advice on their own building problem. The laundry as built (Fig. 1) is almost devoid of ornamentation, depending instead upon the blending of horizontal bands of widows and concrete spandrels, which are given a white sand finish. Four vertical pilasters in the tower lend an appearance of height, and some decoration is introduced in this portion of the building by corrugating the surfaces of the concrete spandrels.

The interior layout was designed to be flexible and adaptable to an efficient flow of work. Columns are on about 20-ft. centers both ways, and the elevator, pipe and vent shaft and stairway are located near the center of the building. On the second and third floors the toilet and locker rooms are placed along the north wall, which, by reason of an adjoining structure, does not con-

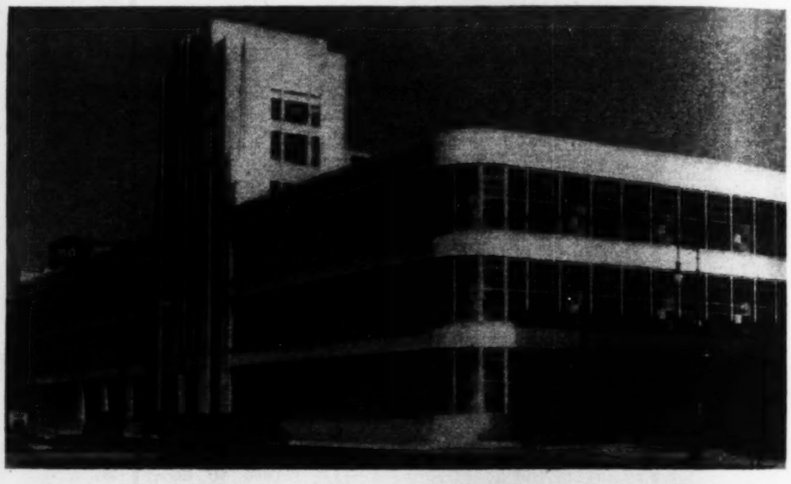
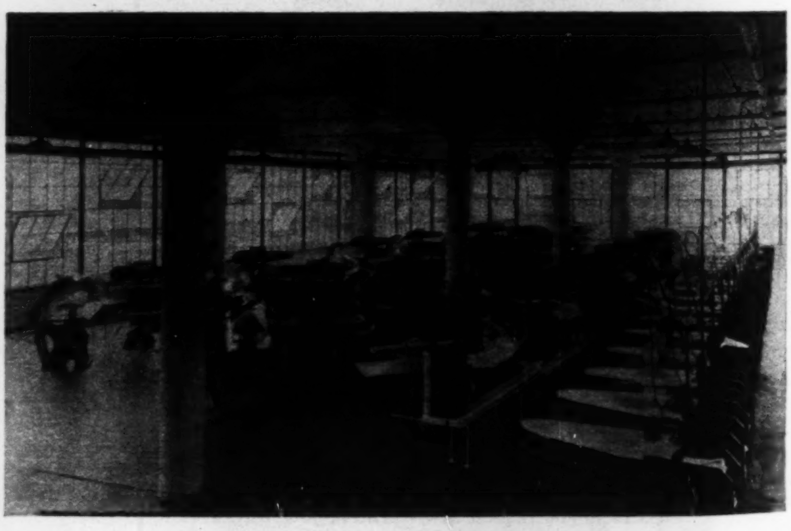
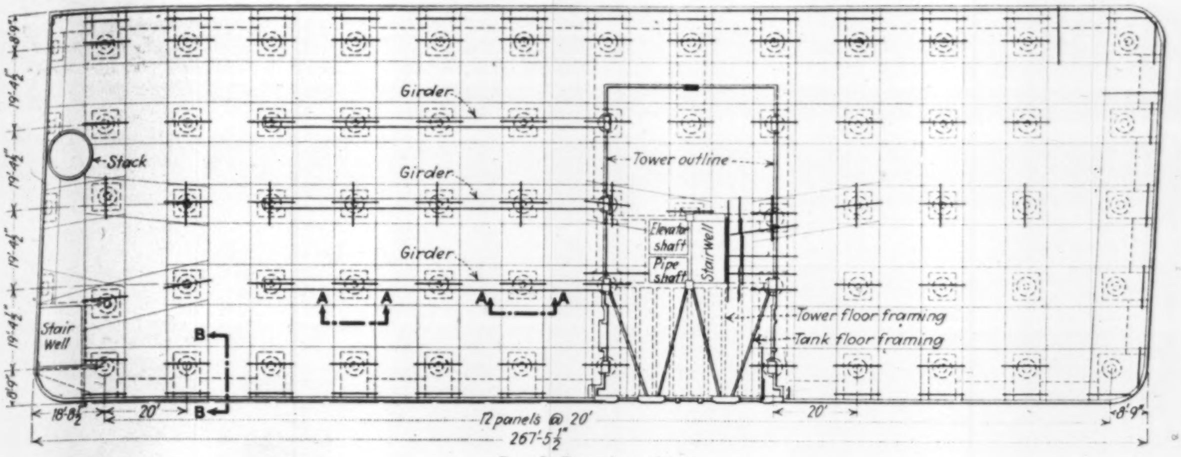


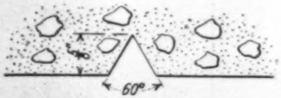
Fig. 1 (above)—New building of Cashman Laundry Corp. in New York is of reinforced-concrete construction with cantilever walls.

Fig. 2 (below)—Continuous window-sash assures a maximum of light, air and cross-ventilation on all floors of the laundry.

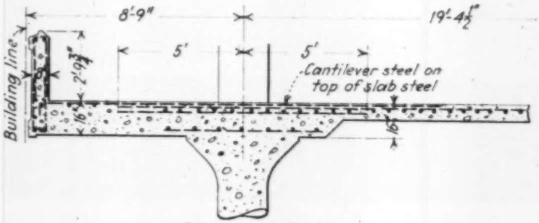



Girder
Girder
Girder
Stack
Tower outline
Elevator shaft
Pipe shaft
Stairwell
Tower floor framing
Tank floor framing
Stair well
A
A
A
A
B
B
8'-9"
19'-4½"
19'-4½"
19'-4½"
19'-4½"
8'-9"
18'-8½"
20'
12 panels @ 20'
20'
8'-9"
267'-5½"

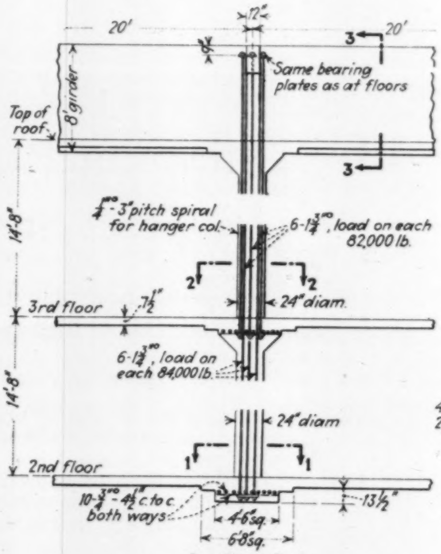
Roof Framing Plan



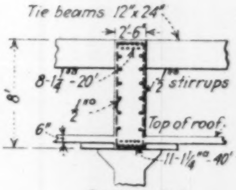
Detail of Expansion Cut in Spandrel Face


8'-9"
19'-4½"
Building line
5'
5'
2'-9¾"
16"
16"
Cantilever steel on top of slab steel

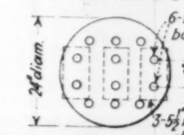
Section B-B


20'
12"
20'
3
3
8"
Same bearing plates as at floors
8' girder
Top of roof
14'-8"
¼"⌀-3" pitch spiral for hanger col.
6-1¾"⌀, load on each 82,000 lb.
2
2
24" diam.
3rd floor
7½"
6-1¾"⌀, load on each 84,000 lb.
14'-8"
24" diam
1
1
2nd floor
10-¾"⌀-4½" c. to c. both ways
4'-6" sq.
6'-8" sq.
13½"

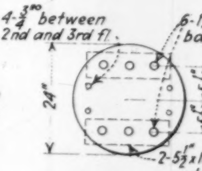
Section A-A
Roof Girders and Hanger Columns


Tie beams 12"x24"
2'-6"
8'
8-1¼"⌀-20'
½"⌀ stirrups
2"⌀
6"
Top of roof
11-1¼"⌀-40'

Section 3-3


24" diam.
6-1¾"⌀ bars
6"
3-5½"x12"x⅞" plates

Section 2-2


4-¾"⌀ between 2nd and 3rd fl.
6-1¾"⌀ bars
24"
5½"
5½"
5½"
2-5½"x18"x⅞" plates

Section 1-1

Fig. 3—Structural details of Cashman laundry include a group of concrete columns suspended from concrete girders in the roof, cantilever walls and V cuts in the concrete spandrel walls to predetermine location of expansion cracks.

tain any windows. Together with a stairwell, the outer partition of these rooms forms a straight unbroken line across the width of the building, leaving the rest of the floors clear for operating purposes.

A rather unusual foundation condition had to be met, since the west or front portion of the plot contained a loose fill of soil and rubbish, with rock some 40 ft. below ground level, while on the east portion the rock outcropped from 10 to 15 ft. above the ground. In the filled area, steel cylinder piles were driven and filled with concrete to support the piers. On the east half of the plot considerable blasting was necessary, and the piers were poured directly on the rock.

The cantilever wall construction is similar to that employed in the Starrett-Lehigh Building, the first row of columns being located 8 ft. 9 in. back from the exterior walls. Details of this are shown in Fig. 3. Continuous sash, which this type of construction permits, not only assures permanent daylight but also provides a maximum of cross-ventilation and air circulation, which in a laundry building are of major importance, and if not secured in this way must be provided by air-conditioning.

Eliminating two rows of columns in the first-story garage section to facilitate truck maneuvering presented an interesting problem. In order to conserve headroom without increasing the first-story height, it was decided to suspend these two rows of columns from the roof. As shown in Fig. 3, this was accomplished by utilizing three reinforced-concrete girders 8 ft. deep, placed above the roof level and spanning four bays in a north-south direction. Three of the five columns beneath each girder serve as supports, while the two intermediate columns are suspended from the girders by 1¾-in. diameter rods. By this arrangement the column elimination on the first floor was effected without sacrificing any headroom and, it is also claimed, at a minimum cost.

For constructing the part of the building adjacent to these suspended columns, unusually heavy timber shoring was necessary until the roof girders could be poured. As a first step in the operations special concrete foundations were poured to carry the shoring. The second-floor slab was then poured, with sleeves inserted at the column locations to permit installation of the hanger rods. The third-floor forms were then erected and the rods put in place, one set extending from the second-floor slab and another set from the third-floor slab upward and into the roof girders. These rods were temporarily held in place

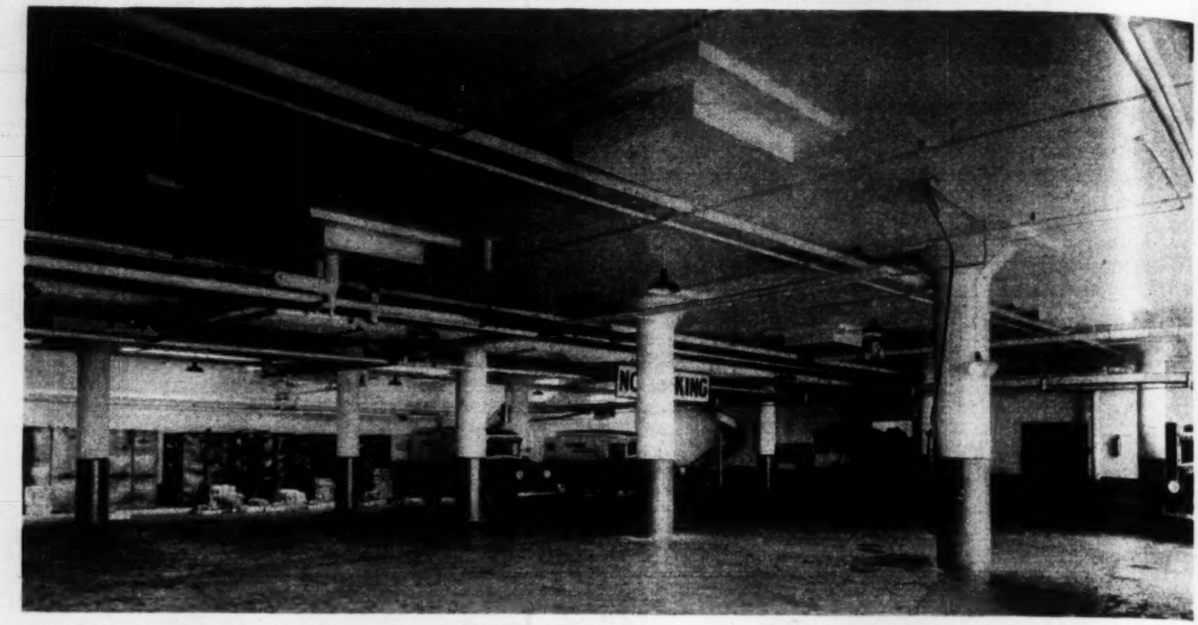


Fig. 4—Trucking area on first floor in which two rows of columns have been eliminated to provide maneuvering space. The inclosures over the bottom of the columns, which are suspended from girders in the roof, are shown in the ceiling of the trucking floor.

while the columns, third-floor slab and roof girders were poured. After the roof girders had obtained their final set, the first-story shoring was removed and the nuts at the lower ends of the hanger rods were tightened with socket wrenches until full and complete bearing was secured. The sleeves in the second floor were then filled with concrete. Fig. 4 is a view of the trucking area, showing the ceiling inclosures over the bottoms of these suspended columns.

Except for the hanger rods and bearing plates, the suspended columns are of typical flat-slab reinforced concrete construction with the usual spiral and vertical reinforcing. No attempt was made to eliminate bond between the column concrete and the hanger rods, but the designers believe that this in no way affects the functioning of the columns as straight compression members in which the reaction is taken by the hanger rods in tension.

With spandrel walls in some cases 267 ft. long, ample provision for expansion was necessary. Two straight-through expansion joints are provided in the 267-ft. length of wall, and in addition at every steel sash tee-mullion (which extends below the sill, through the spandrel wall and down to the floor level) a vertical V expansion cut $\frac{5}{8}$ in. deep was provided on the outside of the wall. It was believed that cracks would be most apt to occur at these points; and if they did occur, that they would be within these V cuts and therefore not noticeable. Examination of the building after some months of use has revealed hair cracks in the apex of some of the V cuts, but no cracks have been discovered elsewhere in the spandrel walls.

Allowance also had to be made for both horizontal and vertical movement in the continuous steel sash. This was accomplished by providing slotted holes where the various members are bolted together and by using coverplates, flashings and mastic calking as required.

The Cashman laundry building was designed and its erection supervised by R. G. and W. M. Cory, architects and engineers, New York. The contractor was the Turner Construction Co., New York City.

Slipping Road Fill Held Up By Steel Suspenders

System of steel plates suspended from top of fill holds slope of refilled slide of highway embankment at Bagnell dam in Missouri

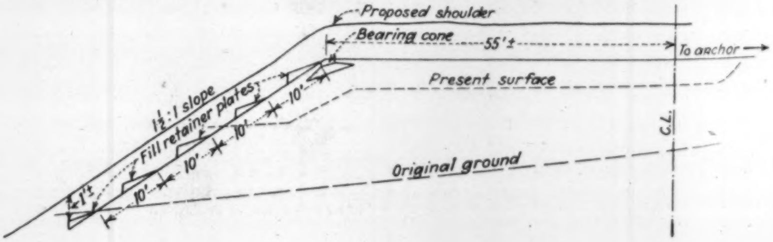
By T. H. Cutler

Chief Engineer,
Missouri State Highway Department,
Jefferson City, Mo.

THE Missouri highway department has successfully applied metal fill-retainers as a means of holding embankment slides. A notable example is a huge fill at the south end of the $30,000,000 Bagnell dam built by the Union Electric Company about 45 miles southwest of Jefferson City. This dam creates the Lake of the Ozarks with some 1,200 miles of shore line and its bordering pleasure resort facilities. The region is traversed by U. S. Route 54, which is now being paved and which crosses the Osage River upon the top of the dam.

For 500 ft. from the south end of the dam the roadway was widened about 200 ft. on the east side and to a shoulder 55 ft. from the center line on the side toward the lake. This was to provide a parking area for the automobiles of travelers who wish to stop to view

Fig. 1—Cross-section of fill, showing line of slippage and arrangement of metal retainers to hold refill.



the lake and dam. Fig. 1 is a cross-section of the fill 256 ft. from the dam. The road was built before the filling of the lake and the widened section at 1 on 1½ slope brought the toe of the fill to the proposed water's edge. The normal elevation of the lake is 660.

When the lake was filled to this elevation its waters saturated the base of the fill, and capillarity softened most of the fill slope. A section 300 ft. in length broke off from 5 to 20 ft. inside the shoulder line and at points varied from 8 to 15 ft. below the shoulder line, the whole affected slope sliding toward the lake.

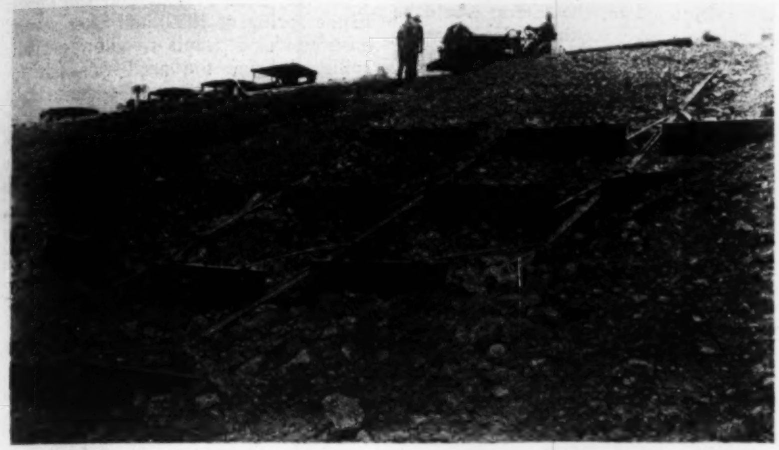


Fig. 2—Part of retainers in place; refill at right and left partly completed and burying the plates and suspenders.

A concrete retaining wall 300 ft. long, carried to solid rock for foundation and designed to support the 25-ft. fill, would have cost a great deal of money. Instead we adopted and installed a section of metal retainers originated by W. L. Cox of Chillicothe.

Fig. 2 is a view of the system nearest the toe of the slope. It very well indicates the multiple plates, each attached to iron bars which extend up the slope. Each of these plates is ordinarily 8 ft. long, made in a double channel form. Plates and bars are designed of various strengths according to the slope and the nature of the fill material. Likewise the spacing of the plates depends upon the steepness of the slope and the plasticity of the fill material. The plates for this type of work are usually made of 8-, 10- or 12-gage metal. Each plate is backed by two-cross-bars of angle iron to which are attached two connection bars, one at the top and one at the bottom, which are brought together and bolted to the main bars extending up the slope.

This suspended type of attachment to the main bars is an essential part of the system. When the fill material strikes one of these plates, it is turned to such position that its resistance is directly normal to the pressure of the fill against it. This equalizes the strain upon all bar members and, considering the multiple action of the system, its strength is developed in much the same fashion as that of a spider web or a fish net.

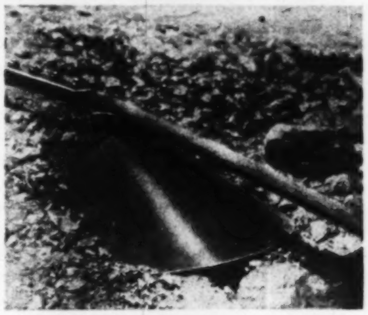
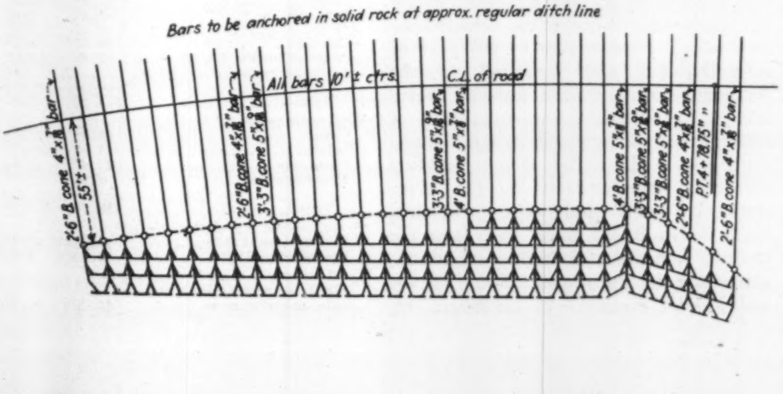


Fig. 3—Cone supports at top of slope prevent suspenders from sinking into the fill.

Fig. 4—Diagram plan of metal retainers and suspenders for sliding road fill at Bagnell dam.



Reference to Fig. 1 will indicate the position of the plates with respect to the final fill slope together with the bearing cone over which the main bars turn to a horizontal position in extending from a point below the shoulder line to their points of anchorage. Fig. 3 is a detail of the bearing cone. The cone is of sheet metal, varying in diameter on our project from 2½ to 4 ft., according to the weight supported. Each cone has the effect of a spread footing and prevents the main bars from sinking into the fill material. Each cone is capped with a pivot bar of iron over which the supporting bar may slide in accordance with any slight motion that may take place.

Fig. 4 is a general layout plan of the system used. The supporting bars are spaced 10 ft. apart for the entire 300 ft. They vary in size as indicated on the drawing according as each supports three, four or five plates. A design must be made for every job to fit the special conditions.

The method used to anchor the supporting bars was simple. The fill was placed on the side of a rocky hill. It was only necessary to extend the bars to a point a few feet into the original ground where solid rock was encountered. A trench parallel to the center line of the roadway was cut in the rock. A heavy iron bar was placed in the trench, and the lateral bars were bolted thereto, after which the trench was filled with concrete. Had the rock been absent, a continuous beam of concrete as a deadman would have been used. Should there be slides on both sides of a roadway, the supporting bars are merely bolted together at the center of the road.

The reconstructed fill was completed Aug. 14, 1932. Since that time there has been no indication of any slipping or movement of the fill material. It has not had frost action or unusual stormwater, but these were not the causes of the slide. The Lake of the Ozarks, the seepage water of which caused the trouble, is "as wet as it will ever be." Its stage has been normal during most of the past two months. Therefore, the writer offers the opinion that the metal fill-retainers, though involving new principles, are entirely satisfactory and applicable to many forms of embankment failure.

The Union Electric Company is now contemplating using the system to construct beaches for the Lake of the Ozarks. Plans and specifications have been prepared. In many locations where beaches are desirable the water deepens too rapidly and the lake bed is rough and rocky. Anchorages will be made at the shore and the system of metal retainers extended out into the lake as desired. It is believed that the surging of the lake will bring in fine material to be caught behind the plates, thus filling the edge of the lake to controllable depths for swimming.

Tuning Up the Saginaw Water Plant

Plant shut down during passage of heavy salt wastes down the river—Activated carbon controls tastes and odors—Red water overcome by secondary dose of soda ash

SATISFACTORY water has been produced from a highly polluted source at the Saginaw (Mich.) purification plant. This plant, put into operation three years ago and heralded then as the last word in flexibility, contains the latest provisions and equipment to soften, filter and render tasteless and odorless a hard, turbid, algae-laden water into which industrial wastes are poured in profusion 30 miles above the intake. As the new plant upon its completion represented the latest developments in water-purification practice, a record of the experience during the tuning-up period should be most helpful to sanitary engineers in appraising modern equipment and methods to meet a high degree of pollution.

The following comments have been obtained from Alfred Eckert, superintendent of filtration, and from a paper he presented last fall to the Michigan conference on water purification.

As described in *Engineering News-Record,* Sept. 11, 1930, p. 410, Saginaw River water is pumped to paddle-wheel mixing chambers in the chemical building where lime and soda ash are added. The water passes to deep coagulation basins equipped with mixing paddles and then to preliminary settling basins where most of the sludge is continuously removed by plow-type apparatus. The effluent goes to a second 3-m.g. settling basin, after which carbon dioxide gas is applied in a separate chamber. The settled effluent is filtered and chlorinated.

Carbon—Powdered activated carbon has been used since March, 1931. Excellent results were obtained with 14 lb. per million gallons until the middle of June, 1931, when an accidental spill of chemical wastes into the river required an increase to 28 lb. In July it was raised to about 50 lb. and has remained at about this figure ever since.

The carbon is fed by a standard alum dry-feed machine ahead of the settling basins or ahead of the filters. Either point has proved satisfactory for taste removal, but feeding ahead of the filters increases the loss of head. It has been found beneficial to distribute carbon throughout the plant so as to sweeten the sludge wherever it may have been deposited. For this purpose Mr. Eckert feels that the storage of spent wash-water and its return to the raw water, carrying with it the carbon that had been deposited on the filters, would be sufficient to stabilize the sludge throughout the plant. All new carbon then would be added to the water ahead of the filters.

Hardness—Saginaw River water has an average total hardness of 300 p.p.m., with the non-carbonate portion ranging from 60 to 200 p.p.m., depending on rainfall and industrial waste pollution. The standard for treated water of 100 p.p.m. is closely adhered to. Excess lime, soda ash and recarbonation were used from the start in the softening process. Later they were supplemented by a secondary application of soda ash to raise the low alkalinities obtained with the excess lime treatments. This secondary soda ash dosage eliminated red-water complaints.

Chlorine—No chlorine was used during the greater part of the first year. The excess lime treatment effectively sterilized the effluent, but as the lime dosage was decreased chlorine became necessary and is now a part of the regular treatment.

Before the completion of the plant, raw Saginaw River water was pumped into the distribution system, without chlorination. The obviously necessary cleaning of the mains presented a major problem. For a period of a month or more the filtered water was delivered into the mains with a caustic alkalinity of 35 p.p.m., and an intensive flushing campaign was inaugurated. Much of the old dirt and scale deposit was flushed out of the mains. Flushing was kept up until analyses of samples from all parts of the distribution system showed the water to be bacterially safe. No chlorine was used.

Industrial Waste Control—Soon after the new plant had started operation, it was evident that wastes from a chemical company located at Midland, 30 miles up the Saginaw River, were responsible for raw-water conditions which not only added considerably to the cost of softening but also imparted an objectionable taste to the finished water leaving the plant. Large quantities of concentrated brine were being dumped continuously into the stream, adding non-carbonate hardness to the river water. Phenol and other chemical wastes also found their way into the stream, imparting a highly objectionable taste to the water. None of the well-known methods of treatment removed this taste except the application of activated carbon.

In January, 1930, the installation of activated-carbon filters was recommended for Saginaw, but on account of the high cost of installation and the promises of the chemical company to eliminate or control their objectionable wastes no action was taken. The chemical company built large impounding reservoirs to store their excess brine wastes, with the idea of emptying these reservoirs only during flood periods. However, flood periods failed to appear in the spring of 1930, and after several unsuccessful attempts to allow periodic spills of brine the need was felt for better control of the raw-water supply. It was believed that if a brine spill of several hours' duration were to be made at Midland, it would pass the intake with little harm if no water were drawn into the plant during that time. When this scheme was tried it was found that when brine was released at Midland a considerably greater concentration of salts was found at the bottom of the river at Saginaw than at the surface. Although no water was drawn into the plant, the more concentrated brine at the bottom of the river found its way into the intake canal and raw-water basin, resulting in a very hard water when the intake was opened again.

The chemical company then constructed a dam and control gates across the entrance of the water plant's intake canal. Since the completion of this dam, it has been possible to dump as high as 300,000 tons of brine containing 163,000 p.p.m. of chlorides without appreciable effect upon the Saginaw water supply. The brine is released at Midland over a 24-hour period or less; and when chemical analysis indicates

TABLE I — SAGINAW WATERWORKS, OPERATION DATA FOR 1930 AND 1931

	1930	1931
Per capita consumption per day, gal.	192	136
Average, m.g.d.	15.5	11.0
Maximum, m.g.d.	23.2	15.0
Minimum, m.g.d.	10.1	8.0
Per cent wash water used	1.12	0.99
Ave. cost per kw.-hr. purchased power, cents	0.9458	0.9634
Power cost per m.g. delivered		
Raw water pump	$1.46	$1.72
Filtered water pumps	6.30	6.35
Wash water pump	0.03	0.03
Auxiliary motors	0.48	0.57
Lights	0.09	0.09
Total	$8.36	$8.76
Chemical costs per m.g.		
Lime	$7.61	$5.70
Soda ash	7.33	5.34
Alum	0.12	0.04
Chlorine	0.02	0.23
Coke for carbon dioxide	0.40	0.30
Activated carbon since 3-9-31	....	1.37
Total	$15.48	$12.98
Total costs per m.g.		
Power	$8.36	$8.75
Labor	11.10	14.18
Chemicals	15.48	12.98
Miscellaneous	3.06	4.04
Total	$38.00	$39.95
Power cost per m.g. per foot raised		
High service, 138 ft.	$0.0458	$0.046
Low service, 25 ft.	0.0584	0.062
Total cost per m.g. per foot raised, 138 ft. for power, labor, chemicals, miscellaneous	$0.275	$0.29

TABLE II — CHEMICAL COSTS DURING SUMMER OF 1932 COMPARED WITH 1930 AND 1931

Item	May, 1932	June, 1932	July, 1932	July, 1931	July, 1930
Lime.......	$4.59	$5.07	$3.95	$5.00	$7.94
Soda ash....	4.38	2.84	2.56	6.57	14.06
Alum.......	0.23	......	......	0.18	......
Chlorine....	0.48	0.53	0.49	0.16	......
Coke for CO_2	0.27	0.28	0.28	0.23	0.32
Activated carbon....	2.80	2.60	2.52	1.69	......
Total...	$12.75	$11.32	$9.80	$13.83	$22.32

that it has reached a point near the Saginaw intake, the control gates in the dam are closed for a period of 36 to 48 hours or until analyses show that it has passed the intake.

Sand—Originally the filters were provided with 30 in. of sand, with a freeboard of 24 in. During the first winter's operation the depth of the sand bed increased to 35 in., due to the retention of large particles of calcium carbonate. The reaction of the carbon dioxide during cold weather was evidently not completed until the treated water came in contact with the surface of the sand bed where the calcium carbonate was deposited as a crust. Upon washing the filters this crust was broken up into small particles which distributed themselves more or less uniformly throughout the bed. It was necessary to screen the sand in all of the twelve filter units during the following spring.

The same condition prevailed during the following winter, and in the spring of 1931 the sand was again screened. Until the summer of 1931 washwater had been applied at a rate to give 23 in. vertical rise per minute. By decreasing the depth of the sand bed to 26 in. the washwater rate could be increased 50 per cent without the loss of any sand. It was believed that the application of washwater at the higher rate would break up and carry away the calcium carbonate particles. While the condition was corrected to some extent, there still was sufficient accumulation in the sand beds to necessitate the screening of the sand this year. During 1930 the percentage of washwater used was 1.19 and during 1931 it was 0.99 per cent.

Flexibility—The two sludge removers must be operated either singly or in parallel and before recarbonation. Better operating conditions probably could be obtained if it were possible to recarbonate before the water reached the primary settling tanks, at or least if it were possible to operate them in series with recarbonation in between. The return of sludge after recarbonation could be utilized to hasten the reaction of the carbon dioxide with the lime-softened water and take much of the load off the filters.

The settling basins were designed for operation in parallel with recarbonation immediately following. They are being operated in series with recarbonation in between. With this set-up only two-thirds of the recarbonation chambers may be utilized and the other third is idle, with water which may become more or less stagnant. The added cost of construction to permit a little more flexibility would not have involved much expense, but to change a recently built plant is quite another problem.

Buying Carbon—Recently the city advertised for bids for a year's requirement (90 tons) of activated carbon and received quotations on thirteen grades ranging in price from $50 to $118 per ton. Because of the lack of suitable laboratory methods of evaluating different carbons for use in water treatment, all bids were rejected, and it is planned to try several different grades on a plant scale.

John R. Baylis, of Chicago, has developed a method for evaluating powdered activated carbons for water treatment, which has considerable merit. It has been found, however, that according to his tests certain carbons which have been more or less successfully used at water-purification plants may be given negative values. When quotations were received, based on the Baylis tests, a powdered carbon quoted at a lower price than the one which had been used was indicated to be the best buy. The results with this carbon so far indicate that it will meet all the requirements.

Equipment Performance—It has not been necessary to use the standby diesel engines, but in order to keep them in good operating condition the entire load of the plant is carried for a period of several hours each week on each engine alternately. Purchased power has been reliable, and although a number of shutdowns have occurred (11 in 1930 and 5 in 1931), due to electrical storms, the return of power was almost instantaneous in each case. In July, 1932, the cost of operating the diesel engines was $0.027 per kilowatt-hour.

The shock-absorber paddle wheels in the coagulation basins have given no trouble, but have performed satisfactorily in the manner for which they were designed.

Plant Makes Metering Feasible—When the new plant was completed there were practically no meters in service. During the last six months of 1930 and the first six months of 1931 meters were installed on almost 80 per cent of the services. This has resulted in greatly reducing the pumpage. The average daily pumpage figures for July of 1930, 1931 and 1932 were, respectively, 584, 375 and 301 m.g.d.

Research Centers Attention on Highway Technique

Heavy program of papers and reports considered by Highway Research Board emphasizes details of road design and construction

TECHNIQUE of design and operation was emphasized in the 30 papers and committee reports considered at the meeting of the Highway Research Board in Washington on Dec. 2 and 3. About 100 representatives from state highway, federal, college and industrial research agencies attended the meeting. Discussion of the papers was limited. Few of the subjects, presented necessarily in abstract, permitted of extended extemporaneous comment. Interest was more clearly manifested by the full attendance at the sessions and the close attention given to the papers.

Management and finance

By broad classification eight of the listed subjects fall within the category of highway management and finance. One of these was presented by title only, and one was withdrawn. Finance was considered specifically in only one report, by Thos. H. MacDonald, chief, Bureau of Public Roads. Calling attention to the emphatic necessity of preparation by research to meet the larger problems of public-roads management, the report outlined the bureau study of taxation and finance made in Illinois following the Wisconsin study reported a year ago. A third study for Michigan is now reaching readiness for reporting.

In a study on highway safety Dr. A. R. Lauer, professor of psychology, Iowa State College, described a series of drivers' tests being conducted on an outdoor test road laid out to include all the normal conditions calling for drivers' action and reaction when lights, signals, direction and warning signs were encountered calling for vehicle control. Tests of about 1,200 drivers were developing facts of value respecting location, type and nature of signs that are most legible or visible. With laboratory studies of optimal colors for stop lights and road markers a probability existed of developing fundamentals of practice of definite value.

A contributory study was presented by W. A. Van Duser, director of vehicles and traffic, District of Columbia, of traffic practices at a number of intersections in Washington, D. C., undertaken for the purpose of accumulating data upon which analyses could be made of the reasonableness or unreasonableness of various regulations. Data were secured at four intersections controlled by traffic lights, three at uncontrolled intersections, and three at intersections with stop signs for through traffic on one street. The law observance was best (85 per cent) at light-controlled intersections and poorest (51 per cent) at the stop-street intersections. Vehicle speeds were studied on uncontrolled secondary streets, on arterial streets protected by stop signs and on streets controlled by traffic lights. A study of the data indicates a reasonable speed that a large majority of drivers will be willing to observe under the different conditions. If the speed limits are set on these bases, it may be possible to curb the small number of dangerous drivers who exceed them. If the limit is unreasonably low, the violators are so numerous that the police cannot cope with them.

A report on traffic-survey methods, by W. Graham Cole, Metropolitan Life Insurance Co., cooperating with the Highway Research Board, stated as primary considerations that: (1) The traffic pattern of a city depends upon the use of the land, distribution of population and motor-vehicle registration, topographical conditions, transportation facilities, the economic and industrial development of the community and condition and widths of thoroughfares. (2) In addition to the collection and analysis of existing information affecting the traffic situation it is essential that field surveys be conducted to determine the existing use and capacity of streets. The report considered in detail the following factors involved in such a survey: (1) the type and object of information collected; (2) time observations were made; (3) the selection of observation points; (4) the methods used to record the data; (5) the selection, training and supervision of field workers; (6) the use of field forms; (7) the summarizations of the field data; (8) the analysis and presentation of results. Typical samples of forms needed for the recording and anlyzing of the data were included.

Continuation of the Massachusetts studies of highway transportation costs were reported by Prof. C. B. Breed, Massachusetts Institute of Technology. Several sections of road, varying in traffic from 100,000 to 1,000,000 vehicles per year, are being investigated in detail. The report discussed the application of the cost facts and attempted to answer some of the questions that can be answered by the application of the proposed method to a limited section of a given road and also to those questions that can only be answered by a more extended application of the method to include an entire state, or at least to comprise a completed traffic pattern of considerable extent. It was suggested that cost studies of road systems can be facilitated by grouping the roads geographically into traffic patterns. Since the characteristics of these patterns will vary in such respects as topography, traffic use, type of improvement and extent of improvement, comparative studies of them should be very illuminating.

Two succeeding reports discussed progress studies being made on air resistance and tractive resistance of motor vehicles. In the report on air resistance, by W. E. Lay, professor of mechanical engineering, University of Michigan, an account was given of experiments being conducted with an automobile having a full-size body built as a floating envelope about the car. Ray Paustian, instructor in civil enginering, Iowa State College, described laboratory calibrations and field studies being made with a gas-electric automobile. In these tests, runs have been made on concrete, treated gravel, untreated gravel and wet muddy roads and curves plotted to show gas consumption, power requirements and tractive resistance at speeds up to 60 miles an hour.

Maintenance studies

A report by the committee on maintenance centered on a study by H. F. Clemmer, engineer of tests, District of Columbia, on treatment of icy pavements, and one on mud-jack soils, by A. C. Benkelman, research engineer, Michigan highway department.

Discussing the use of calcium chloride and sodium chloride for ice removal, the report stated that preliminary tests by the Michigan state highway department upon 28-day-old gravel concrete show that both salts have an injurious effect, the severity depending upon the temperature. For two consistencies of concrete and two intensities of finish, the average rating of the surface condition showed a somewhat less severe effect for calcium chloride, particularly at lower temperatures. It is concluded that the chlorides serve in some way to weaken the mortar bond, inasmuch as spalling of the surface generally occurred over pieces of aggregate, whereas in non-treated specimens the surface remained intact. The tests further show that variation in the amount of chloride, either calcium or sodium, had a very minor influence on the intensity of the effect. A few limited tests indicate that the application of oil to the surface prior to the initial set served to eliminate the injurious effect of the chlorides.

In the selection of soils for mud-jack operations it was stated that success depends to a large degree upon the characteristics of the materials used. The effects of texture, amount of organic material present, amount of cement used and amount of water needed for workability upon the shrinkage properties of the soil appear to be the significant factors. In all, 250 samples of soils used with mud-jacks of both the piston and compressed-air type were analyzed, and the range in satisfactory grading for each type was determined. In general, coarser soil can be used with the compressed-air jack than with the piston jack. From a series of laboratory tests the effects of texture, organic content, water content and cement content upon shrinkage, workability and stability were studied. It appears to be desirable to use as coarse a soil containing as little organic material as possible. Unless the amount of organic material is limited, the use of the customary small amount of cement (5 per cent) will have little effect in reducing shrinkage, since high organic content requires an excessive amount of water for workability.

Design and construction

The dozen papers in the classification of design and construction ranged through materials, equipment and methods. E. C. Lang, engineer of tests, Minnesota highway department, urged that research work is required looking toward the development of specifications and methods of tests for cutting edges for grader blades. An improved machine designed to make bend tests of steel in a theoretically correct manner was described by C. H. Scholer, professor of applied mechanics, Kansas State College.

In continuation of the study on dust-laying material, Fred Burggraf, research engineer, Highway Research Board, described determinations on three roads in North Carolina, Missouri and Nebraska of what becomes of calcium chloride used as a dust palliative on gravel roads. It was concluded that although chemical reaction with the soil and effects of rainfall account for some of the loss, the principal source of dissipation of the calcium chloride was in the maintenance manipulation of the loose coarse material on the surface of the road. These findings were checked by comparative observations on roads maintained in the usual way by frequent dragging of appreciable amounts of loose material back and forth across the surface, with experimental sections upon which discontinuance of maintenance manipulation on the surface allowed the traffic to compact all of the loose, damp material.

Reporting on the effect of aggregates on volume changes and cracking in concrete, Stanton Walker, director of research, National Sand and Gravel Association, arrived at the general conclusions that volume changes in concrete are influenced by the characteristics of the aggregates, but that there is no conclusive information as to what characteristics are responsible for these effects, although there are strong indications that the volume changes in the aggregates themselves and those properties that affect the absorption of the concrete are important.

In a succeeding report Mr. Walker, in conjunction with C. E. Proudley of this association, reviewed various studies that have been made on shales in aggregate; he concluded that since there is such a diversity of materials that are more or less harmful, the naming and placing of specification limits on each of them is impracticable. Therefore, the aim of many studies now being carried on is to develop laboratory tests that will indicate the degree of durability to be expected in service.

A study by A. T. Goldbeck, director, bureau of enginering, National Crushed Stone Association, listed surface coatings on coarse aggregate as (1) stone dust, (2) clay or silt, (3) organic coatings, (4) alkali coatings, (5) bituminous-oil impregnations and coatings, (6) calcareous incrustations, (7) sugar coatings and (8) miscellaneous. Available tests indicate that stone dust may decrease the strength of concrete up to 2 per cent for each 1 per cent of stone dust in the mixture. Clay admixtures seem not to be harmful in lean mixtures of concrete but cause decrease in strength in rich mixtures. When occurring as a coating not easily removed, clay probably prevents proper adhesion. Bituminous-oil coatings of the nature and extent studied decreased the strength of the concrete. This may or may not be serious, depending upon the percentage of surfaces coated. Alkali coatings are not definitely proved to be harmful. Sugar coatings are most decidedly harmful, as are also coatings of organic matter. Miscellaneous coatings include coal dust and dirt from improperly cleaned railroad cars. There is a dearth of information on the effect of surface coatings, and the desirability of investigations on this subject is strongly indicated.

C. A. Hogentogler, highway engineer, Bureau of Public Roads, summarized progress in subgrade research as being now largely in specific problems of test procedure, test apparatus and soil identification. The essential accomplishments of the past year had been as follows: (1) modification of the hydrometer method of mechanical analysis to include the use of new apparatus and to make the method applicable for the analysis of portland cement as well as soils; (2) investigation of the liquid limit device; (3) improvement of the swell test device; (4) development of samplers for obtaining undisturbed soil cores; (5) development of cutting apparatus required in the preparation of undisturbed soil samples for swell tests; (6) design of the drainage indicator, a new apparatus to reveal quantitatively the capillary and drainage properties of soils; (7) development of the flocculation test, which utilizes the degree of flocculation of wet soils as an indication of the presence of properties important with respect to subgrade performance; (8) development of a procedure for making a microscopic identification of crystals furnished by water, soluble constituents of soils and portland cement concrete, and the application of this method of analysis to the study of concrete disintegration; (9) investigation of the causes of detrimental warping in concrete pavements and the development of means for preventing its occurrence; (10) design of an investigation for furnishing data on controlled outdoor frost-heave phenomena and the effectiveness of suggested remedial measures; (11) investigation of the use of physical and chemical admixtures for stabilizing soils to serve as bases for surface treatments or relatively thin pavements in low-cost road construction; (12) a study of the uniformity of samples taken in close proximity to each other in the same soil layer and of those from the same layer of a given soil type in different areas; (13) simplification of the routine testing procedure to permit the selection of representative samples for detailed analysis on the basis of several simple tests perfomed on all of a large group of samples.

Joint design was analyzed in a paper by R. F. Bradbury, director, Wire Reinforcement Institute.

A description of an instrument for measuring surface roughness was given by Homer J. Dana, engineering experiment station, State College of Washington. Two symposiums on curing concrete pavement and resurfacing concrete pavement will be summarized in a future issue.

Letters to the Editor

American Engineering Council and Public Construction

A letter of protest from W. S. Lee and L. W. Wallace

Sir—In the interest of the engineering profession it is obvious that a publication such as *Engineering News-Record* should be fair and truthful in its editorial policy. The editorial entitled "Credit Where Due," appearing on page 630 of the Nov. 24 issue, is neither fair nor true. It is incomprehensible that an editorial so at variance with the facts should have been written and published by the *Engineering News-Record,* since the editor and his associates have been kept currently informed during the last three years as to the activities of Council with respect to increasing construction as a means of relieving unemployment. This editorial is further evidence, however, that the *Engineering News-Record* is unfair and has a studied policy of ignoring the activities of groups that are not motivated by the selfish purposes manifested by the *News-Record* and some of its associates.

The editorial "Credit Where Due" is not the first unfair and unjustified attack made by the *Engineering News-Record* on American Engineering Council and those associated with it. There have been several. If the editor will consult both his files and his memory, he will find recorded protests against his unfairness. A few years ago the *News-Record* printed a letter from the then president of Council protesting against an unwarranted attack upon the motives of one of the most public-spirited and unselfish members of the engineering profession.

In an editorial in the *News-Record* of Oct. 20, 1932, p. 478, entitled "R.F.C. Gains Momentum," appears this statement:

> It is a relief to learn from the past week's report that the long expected acceleration of R.F.C. construction loan operations has come to pass***Further progress is represented in the appointment of 37 regional engineering advisers which will speed up action by clearing up points of doubt and confusion in the minds of applicants, showing them how to proceed in order to put their applications in satisfactory form most rapidly.

In the same issue, p. 482, is an article entitled "Engineers Named to Aid Applicants for R.F.C. Loans." Neither the editorial nor the news article makes any mention of the fact that American Engineering Council was requested to advise the officials of the R.F.C. as to how the work on self-liquidating projects might be simplified and expedited, that Council recommended the use of engineer advisers, and that the engineer advisers appointed by the R.F.C. were selected from a list submitted by Council, or approved by Council, at the request of the R.F.C. In this important matter the editor was not interested in "credit where due," if it meant giving credit to American Engineering Council, which represents 62,000 professional engineers in the realm of public affairs.

Evidently the editor, when he wrote the editorial appearing in the Oct. 20 issue, thought that the appointment of these engineers was a helpful advance step, yet in the editorial of Nov. 24 the implication is clearly given that he thinks the R.F.C. has been in a "deadly stalemate" since early spring. Furthermore, the editor was not fair enough in either his editorial or the article appearing in the Oct. 20 issue to give any credit to American Engineering Council when he knew that the engineer advisers were appointed upon the recommendation of Council.

The editor knows that the Engineer Advisory Board of the R.F.C. resulted from a direct recommendation of Council made to the President of the United States on May 31, 1932. He knows, also, the members of the Engineer Advisory Board were selected from a list of eminent engineers prepared by Council in consultation with the American Society of Civil Engineers, the Associated General Contractors, the American Institute of Architects, the American Institute of Consulting Engineers, and others in the construction industry. He also knows that the purpose of this board is to expedite, not retard, construction.

The editor of *Engineering News-Record* knows that most, if not all of the engineers, including himself, who received an invitation from Senator LaFollette and who appeared at the hearings on the LaFollette Bill which provided for a large bond issue for construction, were suggested to Senator LaFollette by official representatives of Council. He also knows that the provisions of the LaFollette Bill pertaining to an Administration of Public Works and designed to expedite federal construction were largely drafted by the executive secretary of Council at the personal request of Senator LaFollette. He also knows that the executive secretary was officially authorized to aid Senator LaFollette.

The editor doubtless knows that certain sections of what became the Relief Act were drafted by officials of Council at the request of and in cooperation with representatives of the construction industry.

The editor is hereby informed that officials of Council aided in the drafting of the Pittman Amendment to the Relief Act which provided for a national project board and a number of regional project boards; and that this amendment was supported by American Engineering Council in a letter to each member of the Senate. He is further advised that in the said letter Council recommended that the self-liquidating feature be broadened to include renovating or remodeling work. This would have immeasurably increased the amount of construction work which could have been financed under the provisions of the act.

The editor knows that the executive secretary of Council assisted in organizing the Construction League of America and served as a member of its secretariat until March, 1932. He further knows that Council was officially represented at the organization meeting of the Construction League by General R. C. Marshall, Jr., and the executive secretary of Council. The editor may not know that had it not been for the representatives of Council, engineering construction would not have been recognized by the League. Furthermore he may not know that the representatives of Council were largely responsible for professional engineering societies being considered eligible and hence receiving invitations to become members of the League. The editor is undoubtedly ignorant of the fact that the engineers who were among the first elected officers of the League were nominated by the representatives of Council. The editor apparently is not informed as to the fact that the executive secretary of Council, with E. J. Harding, managing director of the Associated General Contractors of America, and Charles F. Abbott, executive director, American Institute of Steel Construction, constituted a committee of the League to confer with officials of the Department of Commerce and the Gifford Committee for the purpose of urging that the Public Works Section of the Gifford Committee be given sufficient personnel and finances to press forward the work it was doing.

The facts are, official representatives of Council were active and helpful in organizing the American Construction League and aided in the conduct of its affairs for many months. The editor should make note of this: if the League had not been organized, there would not have been in existence the Trade Recovery Committee to which he refers.

Perhaps the editor should be pardoned for not knowing *all things*, but he cannot be excused in the light of what he did know, for making the unfair and untrue accusation that Council is "in fact unfriendly to *all measures* that aimed at bringing about business recovery by construction employment."

The President's Emergency Committee for Employment was organized in October, 1930. Among other duties this committee was to urge aggressive action on public works and to *stimulate construction* and *reconstruction* wherever possible. In the early fall of 1930, Council, with seven other professional and trade groups, upon invitation, assisted in the organization of the Public and Semi-Public Works Section of the committee, and supplied it with expert staff assistance. Gen. C. W. Kutz represented Council on the staff of the section and devoted his entire time thereto for many months. Council formed 140 field agencies to collect the necessary information. From 800 to 1,000 engineers participated in this work. This section listed *all authorized and proposed public and semi-public works construction projects, ascertained the status of each, and if any were being unduly delayed made an effort to remove the cause so that the work could go forward.* This section also functioned under the Gifford Committee. Throughout, Council was recognized as the very backbone of the work and was looked to by the Woods and Gifford Committees, the Associated General Contractors, the American Institute of Architects, and the engineering societies for leadership.

From October, 1930, to date, Council has been active in this realm. The 52 State Committees on Engineers and Employment, of Council, are functioning today. Since the passage of the Relief Act these committees have been kept fully informed as to the procedure of the R.F.C. and have been stimulating the making of applications for loans under the provisions of the act. Many members of these state committees are also members of the Trade Recovery Committees. Council has urged its state committees to cooperate actively and whole-heartedly with all movements and agencies designed to relieve unemployment and improve business conditions of every character. The editor of *Engineering News-Record* has at all times known of this activity. He knows it has been going on for over two years and antedated by many months the formation of the Trade Recovery Committees. But for some reason best known to himself he ignored these facts when writing the editorial in question.

Recently Council has taken steps to expedite this work through recommending that engineers be added to the advisory committees of the R.F.C. and by again stimulating the activities of the State Committees on Engineers and Employment. To this stimulation the editor objects, as evidenced by his editorial. He exhibits his spleen by saying without due regard to the facts, Council has been "in fact unfriendly to *all measures* that aimed at bringing about business recovery by construction employment."

All the facts stated herein, and many others, have been told the editor of the *Engineering News-Record* and his associates many times.

If it is the policy of the editor of the *Engineering News-Record* in the interest of the engineering profession to be fair and truthful, he will give this communication as prominent a place in his publication as he gave to his editorial "Credit Where Due," and make an apology for having published such a malicious editorial.

W. S. LEE,
President, American Engineering Council.

L. W. WALLACE,
Executive Secretary,
American Engineering Council.

Washington, D. C.,
Nov. 28, 1932

* * *

Editor's Note: Background of the Editorial Criticized

The issues are whether the Council was "unfriendly" to the Relief Act and its antecedent legislative steps and whether it exerted itself to make the act effective in creating employment. Much of the letter of Messrs. Lee and Wallace is not relevant to these issues. At the same time important facts are omitted. For this reason and because the letter was circulated somewhat widely in mimeograph copy before the original reached this office, it may give rise to erroneous conclusions. Some of the additional facts are therefore set forth in condensed form below. They are confined to events connected with the present public-works situation, covering the period that began late in 1931.

1—Prior to May, 1932, the American Engineering Council did not support federal aid to state and municipal construction to aid employment and revive business. No record appears in the minutes of the January meeting to indicate that it took an interest in the subject or felt concerned about the paralysis of municipal construction. Mr. Lee's views are clearly expressed in the following quotation from our report of the May meeting (*ENR*, May 19, 1932, p. 743):

> "William S. Lee left the chair to express his 'unalterable opposition' to the Civil Engineers' resolution. If a normal program of public construction can be financed by the Reconstruction Finance Corporation, he said, it is already taken care of. The civil engineers, he said, contend that the federal government's credit is necessary to support solvent municipal governments. If solvent, argued Mr. Lee, they can get the money; if not, it would be financial folly for the United States government to advance funds."

The fairness or accuracy of that report has not been challenged.

2—Many months prior to this the American Engineering Council had set up State Committees on Engineers and Employment to cooperate with the President's Organization on Unemployment Relief, which was occupied in organizing charity. Though these committees in general did not promote a public-works program, their work was helpful in revealing employment needs. Later on (in May and June, 1932) the National Committee for Trade Recovery, a wholly separate organization, utilized these state committees in part as a basis for organizing its own state committees.

3—In the early part of 1932 some individual members of the American Engineering Council advocated relief and recovery through public construction, but they did not act by authority of the Council.

4—In April, 1932, a committee of the Council canvassed the views of the representatives of the constituent societies on public construction as a relief measure. For this purpose it sent out a questionnaire of some nine or ten questions, of which the following four are pertinent here:

> 1. Should the federal government extend its public-works program at this time, taking into consideration that it would mean additional taxation?
>
> 2. Should the federal government authorize the issuance of $2,000,000,000 to $5,000,000,000 of bonds for the purpose of making loans to states, counties and municipalities, for public-works construction?
>
> 8. Instead of increasing government expenses and therefore taxation, which would result from extending public works, even if it could be done, would it not be more desirable to broaden the base and increase the capital stock of the federal Reconstruction Act so the corporation could extend loans to a large number of industries?
>
> 9. Would it not be the best way for the federal government to aid in restoring business, to adopt ways and means of enabling legitimate industrial and commercial agencies to secure credit quickly and upon liberal terms?"

The questions did not give a true picture of the public-works movement and were obviously "leading" questions. The returns, reported on May 4, were 3 to 1 in favor of private-industry loans and 3 to 1 against public-works loans.

5—On May 13 the Administrative Board met; this is one of the governing bodies of the American Engineering Council. The meeting was informed of the normal public works legislation program of the American Society of Civil Engineers, and was asked to approve and support this program. After sharp discussion the meeting voted, with certain reservations, "to accept the program submitted by the American Society of Civil Engineers, and appoint a committee to assist in the program." At that time the modified Wagner bill, the most promising legislation for the purpose in view, was pending in Congress. *The committee was not appointed until three months later,* when it was too late to be of service; the Wagner bill had already been passed and approved (July 21) as the Emergency Relief and Construction Act of 1932. Mr. Wallace, as executive secretary of the American Engineering Council, explained this delay in an official communication dated Aug. 11, in these words: "It has seemed advisable not to appoint this committee prior to now." He said further: "In order to carry out the instructions of the Board, however, and *so that no one may be able to say Council did not appoint such a committee,* we are proceeding to set up a committee." (The italics are ours.)

6—A letter from Mr. Wallace to Senator Norbeck on June 3, 1932, contains the following:

> "Council holds that the business of the government should be controlled by the same principles which govern all other sound business, and earnestly recommends. . . .
>
> 1. . . .
>
> 2. That the functions of the Reconstruction Finance Corporation be so broadened that, with proper safeguards, it may make credit more readily available to industry.
>
> 3. Council approves in principle a normal program of federal, state, and municipal public-works construction as an effective and immediate means of increasing purchasing power, stimulating trade recovery and reviving employment.
>
> 4. . . .
>
> It is the general consensus of opinion of the members of the Assembly of Council that *it is highly inadvisable for the federal government to make loans to states, municipalities and other political subdivisions for the purpose of financing their respective public works."* (The italics are ours.)

This statement was written after the action of May 13 to "assist in the program."

7—Appointment of the Engineering Advisory Board of the R.F.C. was reported by us (*ENR*, Aug. 11, 1932, p. 176) as follows: "The chairman of the Board was the President's own selection. The other members were selected from a list submitted by American Engineering Council."

8—Determined action to assist in the passage of the Emergency Relief and Construction Act was carried on by the National Committee for Trade Recovery, which began its work in May, 1932. No such action by the American Engineering Council has come to our knowledge.

9—From the time the Emergency Relief and Construction Act was passed, determined efforts to bring out self-liquidating projects and speed up R.F.C. loan applications have been made by the National Committee for Trade Recovery. No such action by the American Engineering Council has come to our knowledge, and we are not informed that its governing bodies have met to consider or authorize such action.

10—Constant effort has been put forth by the National Committee for Trade Recovery to urge the R.F.C. to render decisions on the many open questions of interpretation and application of the act, to fix moderate and uniform interest rates, and to remove other causes of delay to R.F.C. construction loans. No such action on the part of the American Engineering Council has come to our knowledge, and we are not informed that its governing bodies have met to consider or authorize such action.

11—The claim of Messrs. Lee and Wallace that the Council should have contributory credit for the work of the National Committee for Trade Recovery is subordinate to the following facts: Mr. Wallace took part *unofficially* in the early stages of the work of the Construction League of the United States (formed in September, 1931). However, in January, 1932, the meeting of the Assembly voted that "Council should not affiliate with the League." Mr. Wallace accordingly withdrew from the secretariat of the Construction League in *March;* the Committee for Trade Recovery was organized in *May.* This committee was formed in a series of conferences of a number of engineers and architects acting as individuals, among them Robert D. Kohn, president of the Construction League. Mr. Lee and Mr. Wallace were not present or represented, nor was the American Engineering Council represented. After the organization had been formed, Mr. Kohn undertook to assume its sponsorship on the part of the League, and since then has given much time and effort to its work. At no time have Messrs. Lee and Wallace or the American Engineering Council joined in the work. The facts do not support the claim that "if the League had not been organized there would not have been in existence the Trade Recovery Committee."

Readers are asked to consider these facts in connection with the letter of Messrs. Lee and Wallace. Brief comment on the subject will be found on the editorial page of this issue.

Engineering
News-Record

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Editorial and Publishing Offices at 330 West 42d St., New York; 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, England.

Subscription price $5 per year in the United States; foreign rates on application.
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DECEMBER 8, 1932 Volume 109 Number 23

As to Credit Where Due

OUR recent note "Credit Where Due" (*ENR*, Nov. 24, 1932, p. 630), commenting on a publicity item issued by the office of the American Engineering Council, brings sharp protest from the president and the executive secretary of the Council. Their letter, printed on another page, charges that our note was untruthful and unfair. We believe that the facts of the case, indicated in a memorandum appended to the letter, justify the statements of our earlier note, showing that the Council's opinion during the critical early months of the year was neutral or hostile to federal aid for municipal and state construction, that the favorable action finally taken at the May meeting was nullified by unexplained delays, that opportunity was taken to continue the earlier opposition, and that the Council carried on no activities of helpful kind comparable to the work of the National Committee for Trade Recovery. These are the only issues which we raised. In no sense did we question the ideals and objectives of the Council. And it is clear that the opinions or formal actions of Council, though one may disagree with them, are not just cause for criticism. But when, after the Board of the Council does take action, as it did in approving the public-works program of the American Society of Civil Engineers, this action is quietly nullified by the administrative officers, criticism is warranted. When nullification is followed by attempts to take credit for work which Council's office should have done but failed to do, the matter merits open condemnation. Such a condition affects the whole of the great community which the Council represents.

A Research Obligation

HIGHWAY RESEARCH as expressed in the important group of reports and papers reviewed in this issue suggests further possibilities of great significance. They lie in the opportunity to apply the same ability and effort with which technical problems have been studied to the vital essential of establishing the soundness of highway development. Under the vigorous attack of rival interests and of government agencies desiring a share in the rich income from road users, doubt is growing in the minds of many whether roadbuilding justifies continued extension. This doubt can be dissipated only by facts that research is capable of providing. A duty confronts research that cannot be escaped if it is to justify its claim as a constructive force in highway transportation. To establish the precise function and behavior of materials and design in road structure is obviously important; but this alone, however excellently carried out, cannot make up for neglect of the greater problem that now confronts state and national public roads administrations, to show by incontrovertible proof the solvency of highway development. Unless this is established in the minds of road users beyond successful attack, technical research no less than the roadbuilding art will find its present activities curtailed and its prestige lost. The research agencies that met in Washington last week are challenged by this new problem. The vigor with which they attack it will shape the future of highway construction.

Not Unrestricted Use

PROGRESS is being made toward simplifying the transportation problem, whose growing complications are a matter of nation-wide concern. The court decisions of recent months unite to form the beginning of a substantial foundation for road-transport control in the public interest. An important addition to the growing structure is made by the Texas contract-carrier case which the Supreme Court decided this week, giving powerful support to the doctrine that the state is effectually the trustee of its highways. In this capacity the state may prescribe rules for the use of the highways not only as a protection to the road itself and to other users but also as a safeguard of transportation service broadly considered. In short, the highway is not open to unrestricted use if the state finds and decrees that limiting its use will serve the community more effectively. When this principle is fully and wisely applied it will benefit all interests—the public which owns the road, the motor carrier, the private traveler, and the railway.

Helpful Work Postponed

AFTER THREE YEARS of depression, charity to relieve the hardships of unemployment is in need of every supplementary aid available. In spite of this well-known fact, opposition of various kinds rises up to delay or kill nearly every self-liquidating construction project that is brought forward. New York City affords a good example of this shortsighted policy. A $6,000,000 housing development has been stopped for the time being, even after approval of the R.F.C. had been given and a loan granted. The $30,000,000 Triborough bridge, with foundations completed, has not gone ahead because Acting Mayor McKee refuses to ask the R.F.C. for a loan. And a loan for the $75,000,000 38th St. tunnel of the Port of New York Authority, is delayed because, for one thing, the city of New York has announced its opposition to it. Though Mr. McKee has demonstrated in many ways an able grasp of city problems and a sincere desire for more efficient city government, he is mainly responsible for this obstruction. And though he opposes these work-making projects on one day, on the next he pleads with bankers for a relief loan and with private citizens for contributions to charity funds. None of these projects will cost the city of New York any money, and their construction not only would shorten the breadlines that charity must feed but also would infuse new hope into public-spirited citizens the country over who are laboring hard to put men to work. New York City, in following its present course, is not living up to its opportunity for leadership and example.

Better Management in the County

IN the current clamor for reduction of governmental expenses insufficient attention is given to the savings possible through the consolidation of counties. But when the state legislatures convene this winter much is likely to be done in that direction. Some states will have near the head of their legislative calendars consideration of reports of commissions appointed by their last sessions to investigate all aspects of county government. At least two of these commissions are known to favor sweeping reductions in the number of counties. Responsible local opinion also is tending very rapidly in that direction, as the possible economies of county mergers are coming to be recognized; when these become generally known, the consolidation idea may progress fast and far. The civil engineer has both a responsibility and an opportunity in this movement toward improvement of local government. His responsibility lies in helping to direct action along sound lines. His opportunity will arise from the fact that the larger counties, each made up of several small ones, can give their inhabitants many facilities and services denied a few thousand people in a limited rural area.

The Right Approach

IT OUGHT to be obvious that any attempt to increase the public's regard for engineers by forming an organization dedicated to that purpose is bound to fail. Even the most indirect and artful self-praise is quickly recognized for what it really is, and defeats its own purpose. The profession may therefore take satisfaction in the collapse of a recent attempt to form a new national society designed to raise the engineer's standing.

Any such movement is foredoomed to early death because it is manifestly incapable of accomplishing its objective. The method of approach is fundamentally wrong. Raising the engineer to larger place among men cannot be accomplished by sounding the profession's own praises. Those who propose to do so need a better perspective of professional service and of its relation to the world's work.

No professional group exercises a strong popular appeal, neither engineer nor doctor, lawyer or educator. All these may justly complain, and in their private group meetings often do complain, of too little public recognition. The explanation is simple, for the function of the professional man is to serve his fellow citizens by a skill that they are not equipped to appreciate. Further, the training that is essential to this service engenders a high degree of modesty—a recognition of the inability of any one individual to grasp and use the vast store of accumulated knowledge—which effectively restrains all self-laudatory or publicizing impulses.

Thus, the professional man of worth does not and cannot seek the doubtful honor of newspaper headlines; he derives a deeper and more permanent satisfaction from the knowledge of a task well done. And when he enjoys this satisfaction he need not care whether the world knows of his work. Yet the public is not always blind to devoted service unobtrusively rendered, as shown by the recent press comment on the public service of Robert Ridgway.

It is the man that counts; his work, not his professional badge. All attempts to develop a public belief that the designation "engineer" automatically entitles the wearer to special recognition are therefore misconceived. Until human nature changes no profession as a unit can be raised to some higher plane; individuals will rise, but not the mass. What the profession may properly strive for in its societies and organizations is not the education of the public to an appreciation of the engineer but the education of the engineer to the great possibilities of his profession in public service. This is the true approach to higher ranking in the world. As more individual members of the profession seek to improve the service which they render, wider public recognition will come.

Revising the Relief Act

GREATEST of the tasks facing the Congress which assembled last Monday is that of relieving the unemployment situation. The volume of unemployment is substantially as great as it was in mid-summer, when the last session adjourned, and the situation has become more serious in the interim because of the dwindling of the idle worker's resources with each passing month. The number of jobs has increased somewhat since early fall, but the growth is still discouragingly slow. It is for Congress to devise means to speed up this growth.

In July there was justified expectation that the Emergency Relief and Construction Act would soon make work for many men and thereby progressively rebuild the wage-earning basis of industry and trade. Public works amounting to hundreds of millions of dollars had been checked or abandoned, both because of inability to finance them and because of taxpayers' pressure for reduction in expenditures. Thus a great reservoir of construction needs was waiting to be tapped by the Act. But it soon developed that the Act and its administration were not powerful enough to cause this potential stream of wage-earning work to flow. Up to the present only a few hundred thousand dollars have been paid out of the Reconstruction Finance Corporation's great construction fund, and barely two or three projects have reached the contract stage. It has become certain that Relief Act construction will do little to ameliorate this winter's difficulties.

How the Act can be improved so as to create employment opportunities is the immediate question. The task of revising the Act is not easy, but some of its leading elements are clearly apparent:

(*a*) The self-liquidating restriction, known to have had a large share in the failure of the Act, requires relaxing so that it may apply to useful and productive community works that cannot be placed on a toll basis, and clarifying in respect to benefit assessments.

(*b*) Interest and security conditions of loans need specific definition, for the Reconstruction Finance Corporation has been unwilling to fix them soon enough and definitely enough, and has frequently felt compelled to take the banker's views rather than strive to facilitate construction employment.

(*c*) Rigid limits on amortization under the present Act have interfered with the progress of many projects. They should be liberalized so far as this can be done with safety.

(*d*) Broadening the scope of private-enterprise construction loans, either within the range of public use or beyond that range, will extend the power of the Act.

By means of this kind, the revised Relief Act may yet succeed in releasing the locked-up resources of construction, and it is the major task of the present short session to seek to bring about this result. Any revision, however thorough and effective, probably cannot greatly influence this winter's history, but it will mean much for the revival of employment in spring. If Congress can contribute measurably to reducing the unemployed army during 1933 it will merit lasting recognition.

NEWS OF THE WEEK

Richmond Bridge To Get $1,700,000 as R.F.C. Loan

A LOAN of $1,700,000 to fianance the construction of a bridge over the James River at Richmond was approved by the Reconstruction Finance Corporation on Nov. 30. The money is to be used to pay part of the cost of the James River bridge and the reconstruction of three bridges over Shockoe Creek. The loan will be made to the Richmond Bridge Corp. at an interest rate of 5½ per cent. A toll of 10c. a vehicle is to be charged on the James River Bridge and the street railway company will pay $20,000 a year for the privilege of using the bridges over Shockoe Creek.

The James River Bridge and two of the three other bridges will be of reinforced concrete. The fourth bridge is to be repaved only.

Other loans approved No. 30 were $10,000 to the town of Blackstone, Va., for waterworks extensions and $305,000 to Hopkinsville, Ky., to extend the city's sewer system. That loan is to be secured by a pledge of the sewerage system revenue and a statutory mortgage lien. A fourth loan approved was to the city of Columbus, Ill. It will be $52,000 for construction of five miles of water pipe and a booster pumping station.

J. P. Schwada, city engineer, Milwaukee, Wis., will shortly present a report to the city council urging immediate construction of a 200-m.g.d. water purification project at a cost of $4,500,000. The work is to be financed partially by an R.F.C. loan and partially from earnings. A preliminary plan sufficient for estimates has been developed by the city engineers staff and reviewed by Alvord, Burdick & Howson, consulting engineers. With one or two exceptions only, the various organizations in Milwaukee have favored going ahead at this time. Mr. Schwada has built up a large amount of evidence indicating a serious contamination of the water supply during south winds and occurring at times of storm when it is necessary to by-pass combined storm flow and domestic sewage directly into Lake Michigan.

Amendment of the Wisconsin State constitution confirmed at the Nov. 8 election now permits the water department to incur obligations and not have them considered a part of the city's bonded debt. Milwaukee recently reduced its rate from 7 to 6 cents per 100 cubic feet. Even with this reduction the department can turn over to the corporate fund a profit of $300,000 annually and still amortize the cost of a purification plant in 15 years.

The statement made in these pages last week to the effect that an application for $50,000 will be made to the R.F.C. for the proposed Richmond-Hopewell bridge was in error. The estimated cost of the bridge is $450,000.

Bids Called for San Francisco-Oakland Bridge Piers

Bids have been called for the five main piers in the west channel of the San Francisco-Oakland Bridge and opening is scheduled for Feb. 2 with provision that work start within 30 days after award of contract. Estimated cost of these five piers for the twin suspension spans between San Francisco and Yerba Buena Island is about $8,500,000. Bids for the two large piers east of the island, on the Oakland side, are scheduled for advertising within a few weeks. These piers and the structure in general were described in *ENR*, Oct. 20, 1932, p. 457.

Award of contract hinges upon action of the California Legislature in passing enabling acts to provide funds for approaches and other requirements laid down by the R.F.C. which has agreed to purchase revenue bonds to the total of $62,000,000. Total estimated cost of the project, including approaches, is $75,000,000. Reports indicate that the required legislation will be passed shortly after the Legislature convenes Jan. 3.

In accordance with the California law governing the prevailing wage for public works, the wage scale is fixed in the call for bids. Representative wages in this scale include carpenters, $8; pile drivers, $9; riggers, $11; compressor engineers, $10; hoisting engineers, $9; laborers, $5.50; truck drivers, $6 to $7.50.

Texas Law Regulating Highway Use Upheld by U. S. Supreme Court

THE STATUTE enacted by the Texas state legislature last year providing for regulation of the use of its highways was upheld by the United States Supreme Court in a decision rendered on Dec. 5. The law provides for the control by the state railroad commission over both common carriers by truck and contract carriers by truck. Common carriers are required to obtain certificates of convenience and necessity from the commission, to publish their rates, carry certain types of insurance and to comply with regulations set up by the commission. A lesser degree of control over contract carriers is provided for but all must obtain permits from the commission before they can carry on their business over the state highways and must not establish rates less than those prescribed for common carriers for like service.

Injury to business claimed

The law was attacked by the contract carriers on the ground that it prohibited them from carrying out the terms of the contracts which were in effect when the law was passed, precluded them from transporting freight over the highways under their contracts as private carriers to their great injury and subjected them to criminal prosecution. It was further alleged that enforcement of the act will destroy their business. They claim that the law converted them into common carriers, that their business is not affected with a public interest and that the law discriminates against them as compared with other private carriers.

The Supreme Court in its decision put aside the question whether the statute may be attacked under the due process of law clause and the question whether the statute may be justified on the ground that it is necessary in order to prevent impairment of public service of authorized common carriers adequately serving the same territory, and based its decision on the broad general question of whether the statute may be construed and sustained as a constitutional exercise of the legislative power to regulate the use of state highways. The court further stated that it is clear that the statute does not intend to convert private contract carriers by motor into common carriers.

Highway burden increased

After reviewing the highway transport situation in Texas the court said, "These and other findings and the evidence contained in the record conclusively show that during recent years the unregulated use of the highways of the state by a vast and constantly growing number of private contract carriers has had the effect of greatly decreasing the freight which would be carried by the railroads within the state, and, in consequence, adding to the burden upon the highways. Certainly, the removal or amelioration of that burden, with its resulting injury to the highways, interference with their primary use, danger and inconvenience, is a legitimate subject for the exercise of the state legislative power. That this was one of the chief ends sought to be accomplished by the provision in question, the record amply establishes."

"Turning our attention then to the provision for permits, it is to be observed that the requirement is not that the private contract carrier shall obtain a certificate of public convenience and necessity, but that he shall obtain a permit, the issue of which is made dependent upon the condition that the efficiency of common carrier service then adequately serving the same territory shall not be impaired. Does the required relation here exist between the conditions imposed and the end sought? We thing it does. But in any event if the legislature so concluded, as it evidently did, that conclusion must stand and we are not able to say that in reaching it that body was manifestly wrong.

"Leaving out of consideration the common carrier by truck, impairment of the railway freight service, in the very nature of things, must result to some degree in adding to the burden imposed upon the highways."

"What has been said applies in the main to the other challenged provision authorizing the commission to prescribe minimum rates not less than those prescribed for common carriers for substantially the same service. This provision by precluding the contract carrier from rendering service at rates under those charged by the railroad carriers, has a definite tendency to relieve the highways by diverting traffic from them to the railroads. The authority is limited to the fixing of minimum rates. The contract carrier may not charge less than the rate so fixed, but is left free to charge as much more as he sees fit and can obtain. Undoubtedly this interferes with the freedom of the party to contract, but it is not such an interference as the fourteenth amendment forbids.

"Here the circumstance which justifies what otherwise might be an unconstitutional interference with the freedom of contract is that the contract calls for a service, the performance of which contemplates the use of facilities belonging to the state; and it would be a strange doctrine which, while recognizing the power of the state to regulate the use itself, would deny its power to regulate the contract so far as it contemplates the use."

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Abandonment of Street Widening Starts Suits in Los Angeles

The first of the anticipated damage claims against the city of Los Angeles, Calif., growing out of the abandonment of the Tenth St., opening and widening proceedings, were filed with the city council on Nov. 25. The claims, filed by six persons, aggregate $608,301, and are for attorneys' fees, appraisers' fees and costs in connection with the condemnation suits brought by the city against the property owners, depreciation of the property due to the abandonment of the job, loss of rental and lease value, and loss of use.

Charles M. Babcock, Minnesota Highway Commissioner Resigns

Charles M. Babcock, state highway commissioner of Minnesota, tendered his resignation to Governor Floyd B. Olson on Dec. 5 to become effective Jan. 1. The governor had asked for his resignation on Saturday. No reason for the request was given but it is believed that Commissioner Babcock is a victim of the political axe.

Mr. Babcock, formerly a merchant of Elk River, has been a leader in state and national highway matters for the past two decades. In 1910 he was appointed a member of a three-man commission and in 1917 when the state voted to replace that commission by a single commissioner, Mr. Babcock was appointed to the position. In 1919 he presented to the legislature an amendment to the state constitution providing for a 7,000 mile trunk highway system for the state. The amendment was approved in 1920.

Mr. Babock has served as president of the American Association of State Highway Officials and of the American Road Builders Association. Twice he was appointed by the President as a delegate to the International Highway Congress.

Wm. N. Elsberg, city engineer of Minneapolis, was named highway commissioner to succeed Mr. Babcock on Dec. 6. Mr. Elsberg has been city engineer for the past eleven years. He is a graduate of the University of Minnesota in the class of 1910 and was an engineer in charge of bridge work for the city at the time of his appointment. By the change Mr. Elsberg's salary is reduced $1,500.

◆

A.C.I. Officers Renominated

All the officers and directors of the American Concrete Institute whose terms expire in February have been named to succeed themselves by the organization's nominating committee. S. C. Hollister has been renominated president for a term of four years and P. H. Bates vice-president for a term of two years.

Gas Explosion in Sewers Does Wide Damage in Montreal

A series of explosions in the Northwest section of Montreal early in the evening of Nov. 30 caused wide damage to sewers and houses along the line of the explosions but resulted in no serious injuries to the residents of the district. The first explosion occurred at the intersection of St. Denis Boulevard and Belanger St., and was followed by a series of explosions in connecting sewers over an area more than a mile square. Windows were blown out for blocks, in a number of cases parts of the outer walls of buildings collapsed. Wide damage was done to street pavement.

The cause of the explosions has not been determined but they are believed to have been caused by gasoline or oil vapors in the sewers.

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Subway Extension in Boston Meets With Opposition

The Huntington Ave. subway extension in Boston estimated to cost $9,000,000, which the legislature of the Commonwealth of Massachusetts authorized the city to build in an act passed this year has been disapproved by the directors of the Boston Elevated Railway Co. By a unanimous vote the directors refused to accept the subway act. Previous to their formal action, it had been understood that they have voted in favor of a modified subway plan which contemplated its construction from Gainsboro St. to Copley Square at a cost of $4,800,000.

The act was objected to by the directors on the ground that no modification of the route was possible and that a lease had to be executed prior to the start of construction. Further, it was stated that the subway would largely duplicate the service of the existing subway under Boston Common and Boylston St. and that the rental of 4½ per cent on the construction cost plus the operating cost could not be met from the fares from prospective traffic.

Soviet Photo Agency

RUSSIANS DEDICATE GREAT POWER PLANT ON DNIEPER RIVER

The great Dnieprostroy power plant built by the Russian Soviet government was officially opened on Oct. 10 with charateristic ceremonies which included the award of the Order of Lenin to the leader of the "women's concrete-pouring shock brigade."

The accompanying photograph shows the power house which is notable in that it alone of all the structures was of purely Russian design. The design of the remainder of the project, as described in our issue of June 23, 1932, p. 877, followed American practice. Conspicuous in the speakers stand are A. V. Winter, chief engineer on the project for the Russian government and Hugh L. Cooper, consulting engineer, New York, under whose direction the construction was carried out. Both Mr. Winter and Col. Cooper were decorated by the Soviet Government.

Bids Called for Big Turbines for Hoover Dam Power Plant

The Bureau of Reclamation will receive bids at its Denver office until Feb. 3, 1933, for furnishing three, four or five 115,000 hp., vertical shaft, hydraulic turbines, with or without butterfly type shutoff valves, and one or two 55,000 hp. vertical shaft turbines with governors for installation in the Hoover Dam power plant.

The 115,000 hp. turbines will be the largest capacity turbines yet built. Those built recently for Dnieprostroy have a capacity of 84,000 hp.

◆

Irrigation District Will Pay For All-American Canal

A contract for repayment to the federal government of the cost of the All-American Canal has been signed by the Imperial Irrigation District, according to an announcement made by the Secretary of the Interior on Dec. 3. The Coachella Valley County Water District was represented in the negotiations leading up to the contract.

The contract provides for unification of the lands to be served, by inclusion in the Imperial Irrigation District. It incorporates, however, a number of provisions especially requested by the Coachella Valley interests, including arrangements by which the present Coachella District will retain its corporate entity and certain financial functions. It represent a compromise of the previously conflicting views of the Imperial and Coachella interests.

The canal is estimated to cost about $38,500,000 and will carry water from the Colorado River to the Imperial and Coachella Valleys. This contract will not become effective until certain proceedings are concluded in California, including an election within the Imperial Irrigation District, followed by the usual validation decree. When these proceedings are completed and the contract goes into effect it is planned to request an initial appropriation of Congress for commencing construction.

◆

Hydro Plant on White River Gets Power Commission License

A license for the construction of a 220,000 hp. hydro-electric plant on the White River in Missouri was granted to the Empire District Electric Co. by the Federal Power Commission on Dec. 1.

The project includes a dam across the White River at Table Rock in Taney County near the Arkansas line. When completed, with necessary transmission lines it will involve on expenditure of $30,000,000. The reservoir will extend 65 miles up the river and for lesser distances up the tributaries.

The application has been pending for over eight years, the delays being due to action by the commission, by local interests and the company, according to the power commission. In order to close the procedure, the commission advised the company last May that it was ready to grant the license. The company objected on the grounds that a decline in industrial demand made existing plants adequate for present needs, but the commission, believing that it had not the discretionary powers needed to postpone action indefinitely, on June 30, ordered the plans and specifications approved and a license for a 50-yr. period tendered to the applicant subject to acceptance before Dec. 1. The company accepted the license on Nov. 29.

In view of the company's opposition to acceptance of the license there is little prospect of the work being undertaken immediately.

◆

Eight Bids on 12.7 Mile Tunnel For Aqueduct to Los Angeles

Eight bids for the construction of the proposed San Jacinto tunnel of the Colorado River aqueduct were received when the bids on the tunnel were opened on Nov. 29. In addition, separate bids on the east half and the west half of the tunnel were received from four contracting firms. The low bid on the entire job was submitted by the Metropolitan Engineering Corp. of Los Angeles. Its bid was $7,333,315. The next lowest bidder was Wenzel & Henoch of Milwaukee who bid $7,339,100, within $6,000 of the low bid. The Metropolitan Engineering Corp. also was low bidder on separate bids for both the east and the west half of the tunnel.

The tunnel is one of the major elements in the plan of the Metropolitan Water District of Southern California for the construction of a 240-mile aqueduct from the Colorado River to supply water for the 13 cities making up the district. Work on the tunnel is to be started first as it is expected to require 69 months for its completion.

The tunnel is to be 16 ft. in internal diameter lined with concrete throughout. Cement reinforcing steel and gates are to be supplied by the district.

The construction plans call for the tunnel to be driven from two portal adits and two intermediate adits but the contractor will be permitted to change this plan with the approval of the district's chief engineer, F. E. Weymouth.

The Metropolitan Engineering Corp. is made up of J. P. Porter, Charles R. Ross, George Pollock, T. E. Connolly, the W. F. Hanrahan Co., and A. B. Swinerton. The Metropolitan Construction Co., the third low bidder, is made up of Bechtel-Kaiser Co., Dravo Construction Co., Missouri Valley Bridge & Iron Co., Raymond Concrete Pile Co., Utah Construction Co. and Winston Bros. Co.

The bids were as follows:

Metropolitan Engineering Corp, Los Angeles	$ 7,333,315
Wenzel and Henoch, Milwaukee.	7,339,100
Metropolitan Constr. Co., Los Angeles	8,395,225
Shea, McDonald & Kahn, Los Angeles	8,591,800
Silas Mason Co., Los Angeles	8,845,925
West Slope Constr. Co., Los Angeles	9,773,000
Rosoff Subway Const. Co., New York	10,291,300
Atkinson Const. Co., Los Angeles	13,625,850

Bids on the separate sections of the tunnel were as follows:

ON EAST HALF OF TUNNEL

Metropolitan Engineering Corporation	$3,471,090
Frazier, Davis Company, St. Louis	4,078,150
Metropolitan Construction Company	3,688,680
West Construction Company, Los Angeles	3,680,165

ON WEST HALF OF TUNNEL

Metropolitan Engineering Corporation	$4,338,900
West Construction Company	4,528,625
Metropolitan Construction Company	4,803,945
Frazier, Davis Company	5,438,173

State Council of Engineers Proposed in New York

Setting up a New York State Engineering Council along the lines of American Engineering Council was proposed to representatives of local and national engineering societies of the state at a meeting called in New York on Dec. 6 by Thomas C. Desmond, an engineer recently reelected to the state senate. Senator Desmond pointed out not only the need for statewide representation for the engineering profession in Albany but also the advantages to the engineers themselves in maintaining that contact. L. W. Wallace, executive secretary of American Engineering Council, was the principal speaker.

◆

Cost of Highway to Gulf Coast Results in New Call for Bids

Because the low bid for the construction of 8 miles of embankment and five bridges on the proposed shortcut highway from New Orleans to the Gulf Coast amounted to $1,397,900, or nearly $300,000 in excess of the funds available, the Louisiana Highway Commission has called for new bids to be opened Dec. 20.

Under the plan originally proposed the upper level of the muck in the sea marshes through which the highway runs was to have been removed and replaced by dredged material pumped into the channel created in removing the muck. This type of construction would have resulted in early settlement of the fill and would have permitted putting on a hard surface in the near future. Under the new call for bids an alternate proposal omitting the removal of the surface muck is provided for.

◆

Portland Adopts Revised Code for Concrete Construction

Two classes of concrete with different values of working stresses are provided in the revised sections of the Portland, Ore., building code covering reinforced concrete construction. For concrete prepared by "definite proportions" for a 1:6 mix, e.g. roughly 2,000 lb. concrete, and placed without a resident inspector the permitted compressive stress is 650 lb. per sq.in. For the same basic mix with 7½-gal. of water per sack of cement and with a full time certified inspector on the work, the permitted compressive stress is 800 lb. per sq.in. The purpose of this code provision is to encourage good concrete work and at the same time not require the cost of continuous inspection on small jobs. The revised sections correspond closely to similar sections of the Seattle code.

Under the new code, in the case of a structure requiring a relatively small yardage of concrete the work can be done with the equipment of the average small contractor and the unit stress provides safety without making technical inspection necessary. Such practice is economical for this type of work. For larger structures allowance of increased working stress provides appreciable advantages which warrant the expense of closer control and inspection. On jobs of borderline size the code creates a tendency for encouraging a better class of concrete work and, at the same time, does not penalize well executed, large jobs with low working stresses.

New Jersey Coast Resort Towns Study Beach Protection Problem

Methods for repairing the damage done to the beaches of the pleasure resorts along the New Jersey coast by the recent storm and modes of protecting the coast against further destructive attacks by the sea were discussed recently by the Governor of New Jersey, representatives of the coast towns and members of the State Board of Commerce and Navigation. In the past the state has contributed 50 per cent and the towns 50 per cent of the cost of shore protection measures but at the present time many of the towns are unable to procure funds for necessary repairs to say nothing of protection against further attack.

Two possibilities for obtaining funds were suggested by the Governor. One was to divert highway funds to the shore protection work and the other was to apply to the Reconstruction Finance Corp. for money on the ground that the beaches are or can be made self-supporting through fees for their use.

◆

Bridge Over Burrard Inlet at Vancouver to Be Rebuilt

The Vancouver Harbour Commissioners have been granted authority by the federal government to take over and operate in trust the damaged Second Narrows bridge crossing Burrard Inlet and rebuild it, and E. H. Bridgman, receiver of the Burrard Inlet Tunnel and Bridge Co. has obtained court approval to enter into a contract with the Dominion Bridge Co. for rebuilding the structure, which has been closed to traffic since it was damaged over two years ago. The amount of the contract is stated to be $840,000, and the structure is expected to be ready for use by next spring. Important alterations, which it is thought will do much to eliminate the danger of accidents from shipping and also will facilitate navigation through Second Narrows, are to be made in the reconstruction work. The present bascule span, which is close to the south shore, will be replaced by a fixed span and the adjoining fixed span, farther out, will be replaced by a lift span for the full width of 300 ft. This section of the bridge is the one that was damaged in a shipping accident of two years ago.

◆

Propose Mergers and Elimination of Chicago Area Governments

In the interest of economy and efficiency a reduction from 438 overlapping and duplicating governments in Cook County, Ill., to 132 is proposed in a report submitted Dec. 2 by Griffenhagen and Associates to a state legislative committee on local government. A saving of $21,650,000 or about 5 per cent in the total tax bill is estimated possible.

To serve in place of the discontinued units and to provide more effective and economical administration through a central authority there is proposed to be set up two major units of metropolitan jurisdiction and scope, known as a Metropolitan Public Works Administration and a Metropolitan Police Administration. The function of the former would include control, construction, operation, maintenance and general administration of highways and main streets, of a metropolitan water supply and sewerage system (local sewers would be left to the several municipalities), a metropolitan park, forest preserve and boulevard parkway system (except parks under 20 acres) and all metropolitan planning, zoning and mapping functions. The director of public works would be selected on the basis of ascertained qualifications and a record of accomplishment and serve during good behavior. The internal organization would provide four divisions in a bureau of highways, three divisions each in the bureaus of water supply, of sanitation and of planning and zoning and five divisions of a bureau of parks. In addition would be the necessary staff agencies, technical units and business administration offices for handling contracts, materials engineering and research, for architectural and structural engineering, land acquisition, legal services, special assessment work, financial accounting and budget making.

Public hearings on the report started Dec. 6 and are to be made the basis for bills to be submitted to the legislature which convenes in January.

◆

British Cement Entry Bonded

On the suspicion that British cement is being dumped on the American market the Treasury Department has ordered that bonds equal to the value of all importations of portland cement from Great Britain will be required until the department's investigation into the question of possible dumping has been completed. If dumping is proved, a surcharge will be added to the duty which will place the price on a level with the price in the British market.

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Hoover Dam Notes

Eighty per cent of the excavation of the upstream cofferdam at the Hoover Dam had been completed Nov. 26. Excavation was started during the week ended Nov. 26 to clear away the rock barrier downstream from the lower cofferdam. Three shifts are working daily on the excavation for the Nevada valve house, the upper adit portal and the connecting road. Stripping operations are continuing on the canyon wall on both sides of the river.

* * *

A spectacular rescue was effected Nov. 21, when B. R. Rutledge, an inspector for the Bureau of Reclamation, lost his hold on a suspension rope and started to plunge to the floor of the canyon 400 ft. below. Oliver Cowan, a high scaler, saw Rutledge lose his hold. He swung himself by his suspension rope against the falling body and wedged Rutledge against the canyon wall until assistance arrived. In this way Rutledge fell only 25 ft. and was practically uninjured.

* * *

After considering various alternate schemes for carrying the electric circuits from the power plant to the transformers, with the transformers located on top of the canyon, it has been decided that the most economical arrangement would be to place the main step-up transformers at the power plant and use overhead high voltage circuits to connect the transformers with the high voltage switching station.

SOCIETY CALENDAR

AMERICAN CONCRETE INSTITUTE, annual meeting, Chicago, Feb. 21-24.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION, Detroit, Mich., Jan. 16-18.

AMERICAN ROAD BUILDERS ASSOCIATION, annual convention and road show, Detroit, Mich., Jan. 16-20.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual meeting, New York, N. Y., Jan. 18-21.

AMERICAN SOCIETY OF MUNICIPAL ENGINEERS, annual meeting, Detroit, Mich., Jan. 16-20.

AMERICAN TOLL BRIDGE ASSOCIATION, annual meeting, Camden, N. J., Jan. 16-17.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, annual convention, Detroit, Mich., Jan. 16-18.

CONSTRUCTION LEAGUE OF THE UNITED STATES, Detroit, Mich., Jan. 16-18.

HIGHWAY AND BUILDING CONGRESS participated in by twenty national engineering societies and trade associations, Detroit, Mich., Jan. 16-20.

INTERNATIONAL ASSOCIATION OF PUBLIC WORKS OFFICIALS, Detroit, Mich., Jan. 16-18.

ENGINEERING INSTITUTE OF CANADA, annual meeting, Ottawa, Ont., Feb. 7-8.

NATIONAL CRUSHED STONE ASSOCIATION, annual meeting, Detroit, Mich., Jan. 16-18.

NATIONAL PAVING BRICK ASSOCIATION, annual meeting, Detroit, Mich., Jan. 17-18.

NATIONAL READY MIXED CONCRETE ASSOCIATION, annual meeting, Detroit, Mich., Jan. 18.

NATIONAL SAND & GRAVEL ASSOCIATION, annual meeting, Detroit, Mich., Jan. 17-18.

PORTLAND CEMENT ASSOCIATION, Detroit, Mich., Jan. 16-18.

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Personal Notes

Merrill G. Baker, formerly assistant to the vice-president of Ford, Bacon & Davis, Inc., engineers, New York, and previously vice-president of Vanadium Corp. of America, has been elected president of the Union Steel Castings Co., Pittsburgh, Pa.

Maurice R. Scharff, consulting engineer, Pittsburgh, has renewed his association with the consulting engineering firm of Morris Knowles, Inc., Pittsburgh. Mr. Scharff formerly was vice-president and assistant chief engineer of the firm before his retirement. The activities of the firm will be under the direction of Nathan B. Jacobs and Myron G. Mansfield.

◆

Obituary

Thomas F. Owen, retired assistant city engineer of Cincinnati, Ohio, died at his home there on Dec. 4. Mr. Owen retired from active work in 1930.

Isaac N. Quimby, retired civil engineer, died at his home in Rochester, N. Y., on Nov. 29 following a long illness. Mr. Quimby was 70 years old.

Alexander MacGlashan, assistant city engineer, Jersey City, N. J., died there suddenly on Dec. 6. Mr. MacGlashan was a graduate of Brooklyn Polytechnic Institute and began his engineering work on subway construction in New York City. Subsequently he was with the New York Central R.R. and during the World War was a major in the Corps of Engineers. He has been with the engineering department of Jersey City since 1925.

Bill Authorizing Sewer Rentals Proposed in State of Washington

A bill which would enable residents of suburban areas to create their own sewer districts and finance them through monthly service fees is proposed for introduction into the legislature of the state of Washington at its next session. Where necessary the community would be permitted to connect their system with adjoining municipal systems on a rental basis. The principal purpose of the bill is to aid the communities north of the city of Seattle which are not permitted under the present law to connect their sewers with the city system. The proposed plan would bring temporary relief until a more complete plan for the whole metropolitan district can be worked out.

◆

Starting of New Orleans Bridge Advanced by Loan Approval

One of the last formalities in connection with the start of work on the proposed bridge over the Mississippi River at New Orleans was taken on Dec. 1 when the Interstate Commerce Commission approved a loan of $6,000,000 to the city of New Orleans from the New Orleans Public Belt Railroad Commission, an operating carrier subject to the Interstate Commerce Act, and authorized it to issue the necessary bonds. The commission specified that the bonds are to be sold at par, to bear interest at 5 per cent, and to be superior to all other liens and charges on the bridge and its approaches and on the revenues derived from operating the property.

At present the Southern Pacific is the only railroad which has contracted for the use of the bridge and for the use of the connecting tracks of the Belt Railroad. The commission stated that it is reasonable to assume that some means will be found for serving the Texas & Pacific-Missouri Pacific lines and that a contract can be closed with those companies which will provide additional traffic for the bridge. It called attention to the fact that the Missouri Pacific has applied for permission to construct a bridge over the Mississippi at Baton Rouge. The commission has not acted on the application but its examiner has recommended that the application be denied.

The Reconstruction Finance Corporation has undertaken to provide the money for the construction of the bridge through the purchase of $13,000,000 of the general obligation bonds of the Public Belt Railroad Commission.

◆

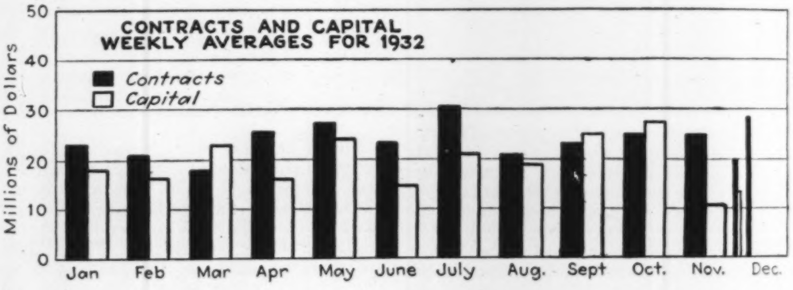
Engineering Contracts and Capital

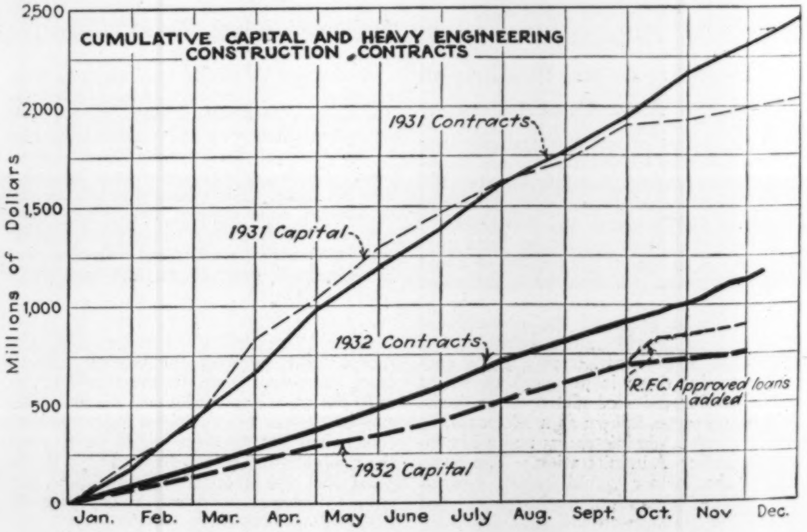
CONTRACTS LET in the heavy engineering construction field last week were unusually heavy, reaching a total of $28,694,000, the highest since the week of November 10. Federal awards amounted to $10,886,000, the heaviest since July 28. State and municipal lettings totaled $12,188, with highway awards showing a gain over the past six weeks, amounting to $8,801,000. The strongest showing of the week was in public building contracts, aggregating $11,085,000, a figure last reached in the middle of July. The running average of all contracts for the past four weeks is $20,649,000, as compared with a weekly average in December, 1931, of $25,026,000.

Large contracts let during the week include superstructure of the Archives Building, Washington, $5,284,000; brewery, Chicago, $1,000,000; postoffice (superstructure), Cleveland $2,844,000; and highways, Illinois, $2,236,000. Low bids were received for the San Jacinto tunnel, California, $7,333,315 and highways, Louisiana, $1,397,000.

Proposed projects announced during the week include a tin mine development, Good Water, Ala., $5,000,000; auditorium, Kansas City, Mo., $3,000,000; apartment, Newark N. J., $1,000,000; mausoleum and chapel, Ridgewood, N. J., $1,000,000; highways, Ohio, $1,064,000; market building, Cleveland, $1,500,000; light plant, Rapid City, $1,000,000; stadium, Jersey City, $3,000,000; grade crossings, Staten Island, N. Y., $1,500,000, and dam, Bowling Green, Ky., $970,000.

New productive capital issues announced total $13,837,000, including private bonds amounting to $1,800,000. Five self-liquidating loans were approved by the Reconstruction Finance Corp. totaling $2,145,000, bringing the loans approved to date to $139,409,000.





Contracts and Capital

CONSTRUCTION

(Thousands of Dollars)

	Weekly Average Dec., 1931	Weekly Average Four Weeks	Week Dec. 8, 1932
Federal government....	$3,325	$7,265	$10,886
State and municipal....	11,974	9,623	12,188
Total public.........	$15,299	$16,888	$23,074
Total private.........	9,727	3,761	5,620
Week's total.........	$25,026	$20,649	$28,694
Cumulative, Jan. 1 to date:			
1931 construction..................			$2,379,098
1932..............................			1,163,970

Decrease, 51 per cent.

NEW PRODUCTIVE CAPITAL

(Thousands of Dollars)

	Weekly Average Dec., 1931	Weekly Average Four Weeks	Week Dec. 3, 1932
R.F.C. loans..........	......	$1,200	$2,100
New capital issues.....	$6,000	7,700	11,700
Total................	$6,000	$8,900	$13,800
Cumulative, Jan. 1 to date:			
1931 new capital....................			$1,998,000
1932 R.F.C. loans approved...		$139,400	
1932 new capital.............		757,400	
1932 total..........................			$896,800

Decrease, 55 per cent.

ENR Cost and Volume Index

Cost		Volume	
December, 1932	**158.46**	**November, 1932...**	**137**
November, 1932..	158.20	October, 1932......	137
December, 1931..	166.23	November, 1931....	180
1931 (Average)...	181.35	1931 (Average).....	220
1930 (Average)..	202.85	1930 (Average).....	260

1913 Average....... 100.00

Construction Equipment and Materials

Huge Truck and Trailer For Heavy Duty

Huge new truck-tractor and trailer equipment built by the Marmon-Herrington Co. for the internationally-owned and operated Iraq Petroleum Co. and believed to be the largest equipment of its kind ever produced has been completed at the company's factory in Indianapolis and shipped to the Near East where it will be used in the construction of a 1,200-mile pipe line across the Syrian desert. The equipment consists of a truck-tractor, semi-trailer and trailer, in themselves weighing a total of 20 tons and capable of pulling 40-ton loads.

The overall length of the equipment is exactly 100 ft. There are 30 tires on the ground. The truck-tractor itself is the Marmon-Herrington 6-wheel model TH-320-6, all wheels driving. The engine has six cylinders and develops 190 hp. Standard and auxiliary transmission have a total of 12 speeds forward, 3 reverse. On the entire equipment all wheels are dual except the front steering wheel. There are air brakes on all wheels except the front wheels on the trailer.

40-ton truck-trailer equipment by Marmon-Herrington

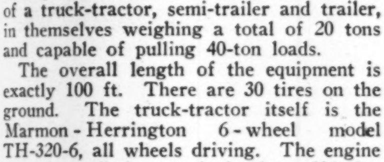
◆

Sprayer for Asphalt Emulsion

A new "direct-from-the-drum" sprayer for the application of asphalt emulsion has recently been announced by the Tarrant Manufacturing Co. of Saratoga Springs, N. Y. The machine is available in two types: the type "B" which will supply either one or two hand hoses and the type "C" which can be used with a hand hose or with a spray bar for sheet application. The machines are especially designed to handle Colas asphalt emulsion.

Air pressure is used as a spraying medium, the manufacturer stating that their experiments with various types of sprayers indicate clearly that this is more satisfactory for emulsion. Air is supplied by a lightweight air-cooled pump driven by a small gasoline engine. The sprayer is mounted on three wheels instead of two so that the necessity of lifting the end of the machine to move it or of blocking the wheels to prevent it tipping is avoided.

Asphalt emulsion sprayer made by Tarrant Manufacturing Co.



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New Equipment in Brief

Reflector Signs. Highway sings of the reflecting button type having a high degree of visibility are announced by the National Colortype Co., Bellevue, Ky. The new signs use the Fireball reflecting button which utilizes all the light falling on the front face of the lens. The lens shape is such as to refract all of the normally incident light rays falling upon the front lens in such a manner that they are concentrated on the reflector of the system and then returned as useful reflected light.

Rubber Paints. The B. F. Goodrich Rubber Co., Akron, Ohio, has developed a new line of rubber paints which have as a base a commercial form of rubber isomer. It is said that the paints possess exceptional properties of adhesion when applied to a properly prepared surface, that they dry in an hour to a hard firm film but retain the elastic properties of rubber and consequently conform to the expansion and contraction of the support, and retain the chemically resistant properties of rubber. The film is not water-absorbent.

Aerator-Filter. Removal of iron and odors from water by pressure aeration and filtration is accomplished by a filter now being built by the Elgin Softener Corp., Elgin, Ill. Water is pumped directly into a pressure filter tank, the top portion of which is filled with compressed air. As the water sprays through the compressed air the iron salts in solution are oxidized to the ferric state. The water then falls into the central section of the tank which acts as a retention chamber. During its passage through the chamber coagulation takes place. The water is filtered at a rate of 3 gal. per minute per square foot of sand area.

New Publications

Nickel-Clad Steel. A bulletin of 12 pages describing the methods of fabrication of nickel-clad steel plates has been published by the International Nickel Co., Inc., 67 Wall St., New York, N. Y. Nickel-clad steel plate is steel plate protected on one side with a dense, homogeneous sheet of pure nickel. The bond is a solid solution of nickel-iron alloy which is formed when the two metals are brought in contact at high temperatures. In effect, the nickel is welded to the steel. The bulletin describes the method to be used in riveting and welding the plates together.

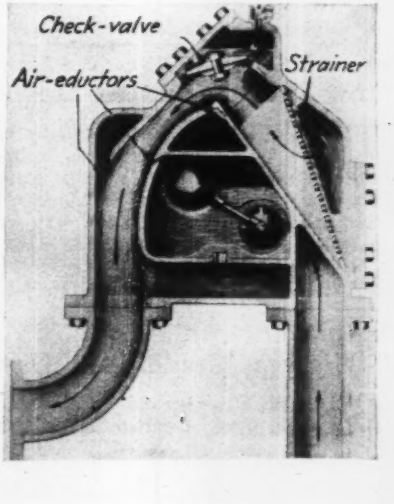
Plywood Forms. "How to make concrete flawlessly smooth at low cost" is the title of a new bulletin issued by Douglas Fir Plywood Manufacturers, Seattle, Wash. It is distributed upon request to contractors and architects. The new bulletin contains deflection graphs and other test data, drawings of typical plywood forms, and photographs of a number of types of construction for which plywood is especially suited. It is claimed that this new form lumber which can be used as lumber and lining combined, practically eliminates rubbing or plastering and greatly reduces form-carpentry. The forms are said to be able to withstand seven to ten re-uses.

◆

Primer and Check Valve Combined for Centrifugal Pumps

A new priming device for centrifugal pumps has been introduced by Barrett, Haentjens & Co., Hazleton, Penna. The device combines in one compact casting a check valve, strainer, and air removing device. It is built in various sizes for a maximum capacity of 1,500 g.p.m. and a maximum operating head of 200 ft. The manufacturer states that when furnished with a special control panel, it makes possible automatic operation of the pump with complete protection against loss of water, air leaks, or break of the column line. Before the initial start, the pump primer must be filled with water through a suitable opening in the discharge line. The pump is then started and the intermittent action of the check valve and float operated mercury switch in the primer device proceeds to start and stop the pump which removes from the suction line an amount of air equivalent to the contents of the primer chamber. The falling and rising water level in the chamber performs the same function in removing the air as the piston of an air pump. When water from the suction line enters the primer channel continuous flow commences.

Automatic primer for centrifugal pumps



Current Construction Unit Prices

Dam and Two Locks, Allegheny River

CONTRACTS FOR Lock and Dam No. 2 and Lock No. 3 on the Allegheny River above Pittsburgh have been awarded by the U. S. Engineer Department to Vang Construction Co., Pittsburgh and Cumberland. Bids were opened October 14. Eight proposals were received for Lock and Dam No. 2, ranging from $1,190,251 (contract) to $1,683,889. For construction of Lock No. 3, eight bids were also received, low bid and contract amounting to $512,444, and high bid totaling $782,720. Following are complete contract unit prices for both jobs.

Item	Lock and Dam No. 2 Quan.	Lock and Dam No. 2 Unit Price	Lock No. 3 Quan.	Lock No. 3 Unit Price
1. Cofferdam, lin.ft.	1,220	$70.00	1,220	$70.00
Concrete class B, cu.yd.	50,819	6.00	37,979	6.00
Com. excav., cu.yd.	35,635	.60	51,471	.60
Rock excav., cu.yd.	36,948	1.00	7,994	1.50
Rock channeling, sq.ft.	14,008	1.00	3,994	1.00
Drilling bolt holes, lin.ft.	90	.50	......	......
Grouting, bbl.	200	3.00	200	3.00
Fill, cu.yd.	4,333	.20	4,980	.20
Riprap, cu.yd.	1,803	1.20	240	6.00
Steel sheetpiling, sq.ft.	718	.70	737	.70
Timber piles, lin.ft.	2,078	.60	180	.60
Oak timber, M fbm.	2.1	100.00	.75	100.00
Com. timber, M fbm.	122.9	70.00	......	......
Struc. steel, lb.	102,043	.045	86,166	.045
Reinforcing, lb.	123,527	.03	95,200	.03
Cast steel, cl. A lb.	801,660	.035	666,441	.035
Cast steel, cl. B lb.	8,392	.035	8,402	.035
Tool steel, lb.	352	.70	306	.70
Iron castings, lb.	15,552	.055	15,356	.055
Bolts, lb.	6,920	.065	4,442	.065
C-I pipe, 6-in., ft.	442	1.30	442	1.30
Steel pipe, 8-in., ft.	392	1.60	366	1.60
Steel pipe, 6-in., ft.	122	1.30	145	1.30
Steel pipe, 4-in., ft.	136	1.00	21	1.00
2. Lock gates complete	1	18,000	1	16,000
3. Lock valves complete	1	4,500	1	4,500
4. Power house complete	1	15,000	1	15,000
5. Lock operating mach.	1	12,500	1	12,500
6. Piping on lock walls	1	9,500	1	9,500
7. Power plant mach. and power house equip.	1	26,500	1	27,000
8. Recess covers complete	1	3,500	1	3,500
9. Concrete class B, cu.yd.	1,130	6.50	10,048	7.00
Fill, cu.yd.	25,969	.20	22,913	.20
Riprap, cu.yd.	273	6.00	152	6.00
Reinforcing, lb.	3,880	.03	4,128	.035
Conc. pipe 54-in., ft.	1,445	9.00	1,458	9.00
Guard fence complete	1	1,400	1	1,400
10. Elec. wiring	1	1,800	1	1,800
11. Cofferdam, lin.ft.	1,393	73.00	......	......
Concrete, cu.yd.	74,225	5.00	......	......
Com. excav., cu.yd.	202,225	.25	......	......
Rock excav., cu.yd.	2,523	1.50	......	......
Rock channeling, lin.ft.	14,906	1.00	......	......
Grouting, bbl.	300	3.00	......	......
Fill, cu.yd.	9,209	.20	......	......
Riprap, cu.yd.	68	6.00	......	......
Derrick, stone, cu.yd.	804	6.00	......	......
Steel sheetpiling, sq.ft.	1,693	.70	......	......
Timber piles, lin.ft.	1,352	.60	......	......
Struc. steel, lb.	1,976	.05	......	......
Reinforcing, lb.	3,030	.03	......	......
Total		$1,190,251		$512,444

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Low Dredging Prices, Mobile Bay

TWO VERY close and unusually low bids were received by the U. S. Engineer Office, Mobile, Ala., for the dredging of 3,600,000 cu.yd. of material from Mobile Bay channel. The low bid of 3.14c. per cu.yd., submitted by the Atlantic, Gulf & Pacific Co., New York, was accepted, contract being awarded early in October for $113,040. Standard Dredging Co., New York, the only other bidder, offered to do the work for 3.24c. per cu.yd., totaling $116,640.

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Highway Grading and Drainage, Arizona

BIDS WERE received late in August by the Arizona state highway department for 8½ miles of grading and drainage excavation on federal aid project E-99-C between Globe and Showlow. One year is allowed for completion, but 70 per cent of the work must be finished by the end of June, 1933. Following are complete unit prices of the three low bidders, with drainage structures included. Five bids were received, ranging from $248,758 to $382,571. (A) L. E. Dixon, Los Angeles; (B) C. G. Willis & Son, Inc., Los Angeles; (C) Ralph Pleasant Const. Co., Phoenix.

Item	Quan.	Unit Prices (A)	Unit Prices (B)	Unit Prices (C)
Clearing and grubbing, sq.	225	$15.00	$9.00	$10.00
Roadway exc., unlcass., cy	312,200	.40	.54	.60
Drainage exc., unclass., cy	7,301	.30	1.00	.385
Slides and overbreakage, cy	24,978	.30	.405	.40
Struc. exc., unclass., cy	2,291	1.50	1.50	1.75
Borrow exc., unclass., cy	73,641	.30	.36	.35
Earthwork overhaul, sta. yd.	251,757	.01	.02	.015
Concrete, class A, cy.*	774	20.00	19.25	23.00
Concrete, class B, cy.*	184	21.00	22.25	23.00
Reinf. steel in place, lb.	72,009	.045	.042	.0425
24-in. corr. metal pipe, ft.†	1,892	2.00	2.00	2.15
30-in. corr. metal pipe, ft.†	530	2.50	2.50	2.85
36-in. corr. metal pipe, ft.†	1,462	3.25	4.50	4.30
36-in. perf. metal pipe, ft.†	40	4.50	4.00	4.85
Riprap in place, cy.	737	2.00	5.00	1.75
Cattle guard, each	1	300.00	500.00	400.00
Cable road guard in place, ft.	21,150	.40	.60	.50
Std. line fence in place, ft.	1,812	.15	.08	.10
Rebuilding fence, ft.	155	.17	.05	.10
Galv. iron pipe, ft.	300	.35	.30	.40
90 deg. 36-in. corr. pipe elbow	1	10.00	10.00	25.00
Structures over 20 ft. clear span:				
Drainage excav., unclass., cy	2,018	.30	1.00	.385
Struc. excav., unclass., cy	1,626	1.50	1.50	1.75
Concrete, class AA, cy.*	18	60.00	60.00	60.00
Concrete, class A, cy.*	1,201	20.00	21.75	23.00
Concrete, class B, cy.*	230	17.00	16.50	23.00
Reinf. steel in place, lb.	151,785	.045	.042	.0425
Fixed plate bridge seats	16	3.00	5.00	5.00
Expansion rocker bridge seats	16	35.00	50.00	40.00
Totals		$248,757	$316,725	$330,480

* All concrete prices include cement.

† Pipe in place exclusive of excav. and concrete.

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Three Highway Projects, Delaware

BIDS WERE received Oct. 18 by the Delaware state highway department on three projects involving grading, borrow, structure and surface treatment. Complete unit prices of all three projects follow:

GRADING, 3.22 MILES, BEAR-HARE'S CORNER

	(1)	(2)
Excavation, 80,000 cu.yd.	$0.95	$1.59
Concrete, class A, 80 cu.yd.	30.00	30.00
Reinforcing steel, 1,200 lb.	.05	.07
Cast iron castings, 7,000 lb.	.05	.07
Reinforced concrete pipe:		
15-in., 240 lin.ft.	2.00	2.50
18-in., 600 lin. ft.	2.50	3.00
24-in., 300 lin.ft.	3.50	3.50
30-in., 60 lin.ft.	5.00	5.00
36-in., 150 lin.ft.	6.00	8.00
48-in., 100 lin.ft.	10.00	4.00

Bidder	Total Bid
1. Vincent Schiavi, Townsend, Md.	$84,040
2. Edward Fay & Son, Philadelphia	136,524

BORROW, 30,000 CU.YD., CHESTER ST. CUTOFF, NEWCASTLE

Bidder	Unit	Total
1. Olivere Paving & Const. Co., Wilmington	$0.82	$24,600
2. Wilson Contracting Co., Wilmington	.82	24,900
3. Robert S. Ambler, Philadelphia	.84	25,200
4. D. E. O'Connell & Sons, Ridley Park, Pa.	.94	28,200
5. Vincent Schiavi, Townsend, Md.	1.05	31,500
6. Edward Fay & Son, Philadelphia	1.46	43,800

SURFACE TREATMENT, 1.5 MILES, HAZLETTVILLE RD.

Bidder	8,000 Gal. Cold Primer	8,000 Gal. Hot Application	Total Bid
1. Field Barker & Underwood, Upper Darby, Pa.	$0.10	$0.11	$1,680
2. Barrett Co., Philadelphia	.097	.1155	1,700
3. Good Roads Co., Upper Darby	.1148	.1248	1,917
4. Lansdall Co., Hackensack, N. J.	.119	.126	1,960